Life Scope i
BEDSIDE MONITOR
BSM-2301A/2304A

Life Scope L
BEDSIDE MONITOR
BSM-2351A

0614-006206H

Model: BSM-2301A/2304A/2351A

Manual code no.: 0614-006206H

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GENERAL HANDLING PRECAUTIONS

This device is intended for use only by qualified medical personnel.
Use only Nihon Kohden approved products with this device. Use of non-approved products or in a non-approved manner may affect the performance specifications of the device. This includes, but is not limited to, batteries, recording paper, pens, extension cables, electrode leads, input boxes and AC power.

Please read these precautions thoroughly before attempting to operate the instrument.

1. **To safely and effectively use the instrument, its operation must be fully understood.**

2. **When installing or storing the instrument, take the following precautions:**
    (1) Avoid moisture or contact with water, extreme atmospheric pressure, excessive humidity and temperatures, poorly ventilated areas, and dust, saline or sulphuric air.
    (2) Place the instrument on an even, level floor. Avoid vibration and mechanical shock, even during transport.
    (3) Avoid placing in an area where chemicals are stored or where there is danger of gas leakage.
    (4) The power line source to be applied to the instrument must correspond in frequency and voltage to product specifications, and have sufficient current capacity.
    (5) Choose a room where a proper grounding facility is available.

3. **Before Operation**
    (1) Check that the instrument is in perfect operating order.
    (2) Check that the instrument is grounded properly.
    (3) Check that all cords are connected properly.
    (4) Pay extra attention when the instrument is combined with other instruments to avoid misdiagnosis or other problems.
    (5) All circuitry used for direct patient connection must be doubly checked.
    (6) Check that battery level is acceptable and battery condition is good when using battery-operated models.

4. **During Operation**
    (1) Both the instrument and the patient must receive continual, careful attention.
    (2) Turn power off or remove electrodes and/or transducers when necessary to assure the patient’s safety.
    (3) Avoid direct contact between the instrument housing and the patient.

5. **To Shutdown After Use**
    (1) Turn power off with all controls returned to their original positions.
    (2) Remove the cords gently; do not use force to remove them.
    (3) Clean the instrument together with all accessories for their next use.

6. **The instrument must receive expert, professional attention for maintenance and repairs. When the instrument is not functioning properly, it should be clearly marked to avoid operation while it is out of order.**

7. **The instrument must not be altered or modified in any way.**

8. **Maintenance and Inspection:**
    (1) The instrument and parts must undergo regular maintenance inspection at least every 6 months.
    (2) If stored for extended periods without being used, make sure prior to operation that the instrument is in perfect operating condition.

(3) Technical information such as parts list, descriptions, calibration instructions or other information is available for qualified user technical personnel upon request from your Nihon Kohden distributor.

9. When the instrument is used with an electrosurgical instrument, pay careful attention to the application and/or location of electrodes and/or transducers to avoid possible burn to the patient.

10. When the instrument is used with a defibrillator, make sure that the instrument is protected against defibrillator discharge. If not, remove patient cables and/or transducers from the instrument to avoid possible damage.

WARRANTY POLICY

Nihon Kohden Corporation (NKC) shall warrant its products against all defects in materials and workmanship for one year from the date of delivery. However, consumable materials such as recording paper, ink, stylus and battery are excluded from the warranty.

NKC or its authorized agents will repair or replace any products which prove to be defective during the warranty period, provided these products are used as prescribed by the operating instructions given in the operator’s and service manuals.

No other party is authorized to make any warranty or assume liability for NKC’s products. NKC will not recognize any other warranty, either implied or in writing. In addition, service, technical modification or any other product change performed by someone other than NKC or its authorized agents without prior consent of NKC may be cause for voiding this warranty.

Defective products or parts must be returned to NKC or its authorized agents, along with an explanation of the failure. Shipping costs must be pre-paid.

This warranty does not apply to products that have been modified, disassembled, reinstalled or repaired without Nihon Kohden approval or which have been subjected to neglect or accident, damage due to accident, fire, lightning, vandalism, water or other casualty, improper installation or application, or on which the original identification marks have been removed.

In the USA and Canada other warranty policies may apply.

CAUTION

United States law restricts this device to sale by or on the order of physician.

EMC RELATED CAUTION

This equipment and/or system complies with the International Standard IEC 60601-1-2 for electromagnetic compatibility for medical electrical equipment and/or system. However, an electromagnetic environment that exceeds the limits or levels stipulated in the IEC 60601-1-2, can cause harmful interference to the equipment and/or system or cause the equipment and/or system to fail to perform its intended function or degrade its intended performance. Therefore, during the operation of the equipment and/or system, if there is any undesired deviation from its intended operational performance, you must avoid, identify and resolve the adverse electromagnetic effect before continuing to use the equipment and/or system.

The following describes some common interference sources and remedial actions:

1. **Strong electromagnetic interference from a nearby emitter source such as an authorized radio station or cellular phone:**
   Install the equipment and/or system at another location if it is interfered with by an emitter source such as an authorized radio station. Keep the emitter source such as cellular phone away from the equipment and/or system.

2. **Radio-frequency interference from other equipment through the AC power supply of the equipment and/or system:**
   Identify the cause of this interference and if possible remove this interference source. If this is not possible, use a different power supply.

3. **Effect of direct or indirect electrostatic discharge:**
   Make sure all users and patients in contact with the equipment and/or system are free from direct or indirect electrostatic energy before using it. A humid room can help lessen this problem.

4. **Electromagnetic interference with any radio wave receiver such as radio or television:**
   If the equipment and/or system interferes with any radio wave receiver, locate the equipment and/or system as far as possible from the radio wave receiver.

If the above suggested remedial actions do not solve the problem, consult your Nihon Kohden Corporation subsidiary or distributor for additional suggestions.

This equipment complies with International Standard IEC 60601-1-2 (1993) which requires CISPR11, Group 1, Class B. Class B EQUIPMENT is equipment suitable for use in domestic establishments and in establishments directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

In IEC 60601-1-2 Medical Electronic Equipment, Part 1: General Requirements for Safety, 2. Collateral Standard: Electromagnetic compatibility-Requirements and test. Section 36. 202. 2 Radiated radio-frequency electromagnetic fields, PATIENT COUPLED EQUIPMENT and/or SYSTEMS applicable IMMUNITY test methods are under consideration at SC62A/WG13. The 3 V/m IMMUNITY level may be inappropriate especially when measuring SpO_2 because physiological signals can be much smaller than those induced by a 3 V/m electromagnetic field.

When measuring SpO_2, various interference may produce false waveforms which look like pulse waveforms. SpO_2 value and pulse rate may be measured from these false waveforms, causing the alarm to function improperly.

When installing the monitor, avoid locations where the monitor may receive strong electromagnetic interference such as radio or TV stations, cellular phone or mobile two-way radios.

WARNING

Interaction Between Minute Ventilation Rate-Adaptive Pacemakers and Cardiac Monitoring and Diagnostic Equipment*

The bioelectric impedance measurement sensor of a minute ventilation rate-adaptive implantable pacemaker may be affected by cardiac monitoring and diagnostic equipment which is connected to the same patient. If this occurs, the pacemaker may pace at its maximum rate and give incorrect data to the monitor or diagnostic equipment. If this occurs, disconnect the monitor or diagnostic equipment from the patient or change the setting on the pacemaker by referring to the pacemaker's manual. For more details, contact your pacemaker distributor or Nihon Kohden distributor.

* Minute ventilation is sensed in rate-adaptive pacemakers by a technology known as bioelectric impedance measurement (BIM). Many medical devices in addition to pacemakers use this technology. When one of these devices is used on a patient with an active, minute ventilation rate-adaptive pacemaker, the pacemaker may erroneously interpret the mixture of BIM signals created in the patient, resulting in an elevated pacing rate.

For more information, see the FDA web site.
http://www.fda.gov/cdrh/safety.html

Conventions Used in this Manual and Instrument

Warnings, Cautions and Notes

Warnings, cautions and notes are used in this manual to alert or signal the reader to specific information.

WARNING

A warning alerts the user to possible injury or death associated with the use or misuse of the instrument.

CAUTION

A caution alerts the user to possible injury or problems with the instrument associated with its use or misuse such as instrument malfunction, instrument failure, damage to the instrument, or damage to other property.

NOTE

A note provides specific information, in the form of recommendations, prerequirements, alternative methods or supplemental information.

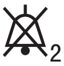
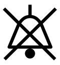
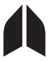
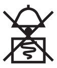
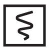
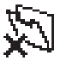
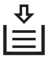
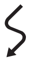
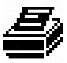
Explanations of the Symbols in this Manual and Instrument

The following symbols found in this manual/instrument bear the respective descriptions as given.

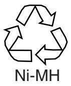
On panels

Symbol	Description	Symbol	Description
⏻	AC operation	🚹	Defibrillation-proof type BF applied part
⊙	“On” only for a part of instrument	⬄	Data input/output
○	“Off” only for a part of instrument	⇔	Input/output terminal
▭	Battery operation	⊖→	Output terminal
→▭	Battery charging	∿	Alternating current
🔕	Alarm suspend	▽	Equipotential terminal
	NIBP	🏭	Year of manufacture
⏲	NIBP interval	SN	Serial number
◇	NIBP start	**IPX4**	Splash-proof equipment
▽	NIBP stop	**IPX7**	Watertight equipment
▣	Menu	⏚	Protective earth
⌂	Home (monitoring screen)	⚡	High voltage
⚠	Attention, consult operator’s manual	⌇	Record start/stop (on the WS-231P recorder module)
♥	Defibrillation-proof type CF applied part	⇩≡	Out of paper (on the WS-231P recorder module)
CSA	CSA mark		

On screen

Symbol	Description	Symbol	Description
	Alarm silence with remaining minutes	♥	QRS/pulse sync mark
	Alarm off		Respiration sync mark
	Alarm recording off	⤒	Value out of range
	Recording	▶	Current measuring value
	Paper magazine open	▲ ▼ ◀ ▶	Adjust setting/Scroll data
	Out of paper	⌖	Touch screen calibration mark
	Network communicating		Waveform cascaded
	Printer (when QI-111P network printer card is used)		

Others

Symbol	Description
	Recycle (On battery pack)

Section 1 General

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Section 1 provides a general overview of the equipment and how to operate it. If you have not used a BSM-2300A bedside monitor before, read this section first.

- Features
- Components in the system
- Panel descriptions
- Screen displays
- Basic operation concepts
- Important safety information

Introduction

The Life Scope i BSM-2301A/2304A hardwire bedside monitor and The Life Scope L BSM-2351A hardwire bedside monitor have several connectors for ECG, respiration in impedance method, SpO_2, NIBP, IBP and temperature monitoring and multi-parameter socket for IBP, respiration by thermistor method and CO_2 monitoring. Its easy operation and compact lightweight design lets you use this bedside monitor in the general ward, ER, RR, ICU, NICU, operating room and for patient transportation. For portability, it can operate on battery power as well as AC power.

For simplicity, the suffix A will be omitted in this manual. There is no difference in operation among models with different suffixes unless otherwise specified.

NOTE

Use only Nihon Kohden parts and accessories to assure maximum performance from your instrument.

Features

- **Hardwire system**

BSM-2301/2351:	Monitors ECG, impedance method respiration, SpO_2 (Nihon Kohden probes), NIBP and temperature. With the multi-parameter socket, IBP, thermistor method respiration or CO_2 can be monitored.
BSM-2304:	Monitors ECG, impedance method respiration, SpO_2 (Nellcor probes), NIBP, IBP and temperature. With the multi-parameter socket, IBP, thermistor method respiration or CO_2 can be monitored.

- **AC or battery (option) operation**
  The monitor can operate on AC power or battery for up to 3 hours.

- **Color data display**
  Detailed information is displayed on the wide angle, 8.4 inch color LCD (BSM-2301/2304) or 10.4 inch color LCD (BSM-2351) . Monitoring parameters are automatically identified.

- **Easy operation by the hard keys and touch screen keys**
  The monitor can be operated using the touch keys on the screen, as well as the hard keys on the panel.

- **Highly reliable ECG monitoring**
  Arrhythmia can be analyzed and ST level can be measured. The dominant QRS can be changed any time for template-matching analysis of arrhythmia.

- **Review windows for viewing saved data**
  Saved data can be displayed on the trend window, list window, arrhythmia recall window and alarm history window.

- **Function keys**
  There are three function keys at the upper left corner of the screen. A function can be assigned to each key, for example, freezing waveforms and displaying the MENU window.

- **Thermal array recorder with 50 mm width paper (option)**
  Waveforms, numeric data, trendgraphs, and vital signs lists can be recorded manually or automatically on the optional WS-231P recorder module. Up to three channels can be recorded.

- **Central monitor connection (option)**
  When the optional QI-101P network card is installed in the bedside monitor, the bedside monitor can be connected to the monitor network or any other bedside monitor in the network. Waveforms and data of the bedside monitor can be sent to the central monitor. An interbed data and alarm of any patient in the same network can be displayed on the bedside monitor.

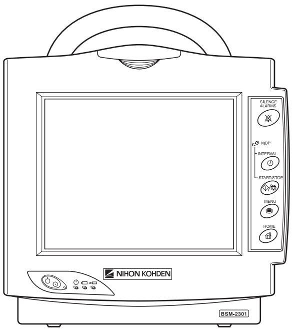
- **Printing on a Network Printer (option)**
  When the optional QI-111P network printer card is inserted into the bedside monitor, the data on the review windows and numeric data of the monitoring parameters can be printed on a network printer.

- **Wireless LAN system (option)**
  When the optional QI-210P wireless LAN station is connected to the bedside monitor and when there are several QI-902R wireless access points installed in the facility, the signal from the bedside monitor can be received by radio communication with the wireless LAN access point. The wireless LAN access point is connected to the central monitor network. For details, contact your Nihon Kohden distributor.

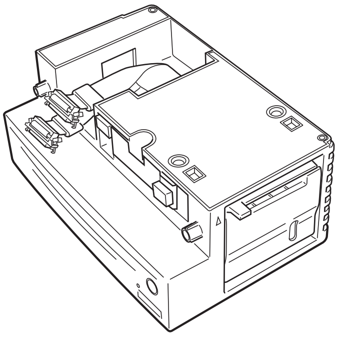
- **Connecting Oridion Microcap capnograph monitor (option)**
  With the optional QI-235P interface, Oridion Microcap® capnograph monitor can be connected to the monitor to display the data acquired by the Microcap®. For details, refer to the QI-235P interface manual.

- **Anesthesia monitoring (option)**
  When the optional AG-920R multigas unit is connected to the monitor, the anesthetic gas can be monitored. To connect the multigas unit, the optional YJ-231P connection cable is required. For details, refer to the AG-920RA/RK multigas unit manual.

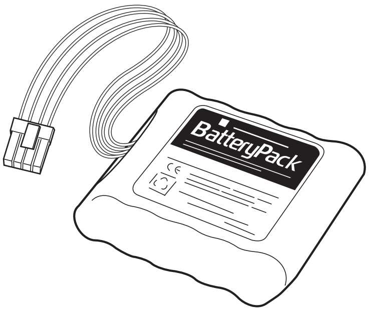
Composition


NIHON KOHDEN
BSM-2301

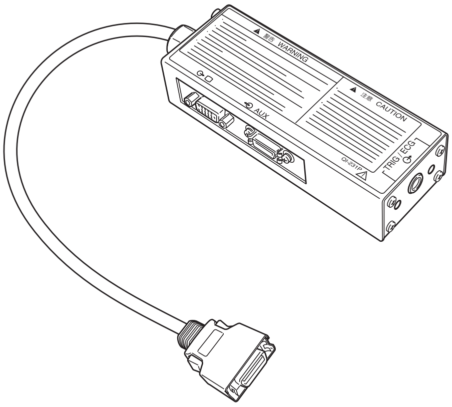
Bedside Monitor
BSM-2300



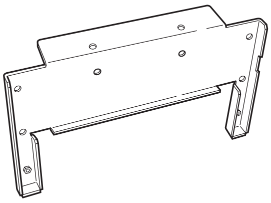
Recorder Module (option)
WS-231P


BatteryPack

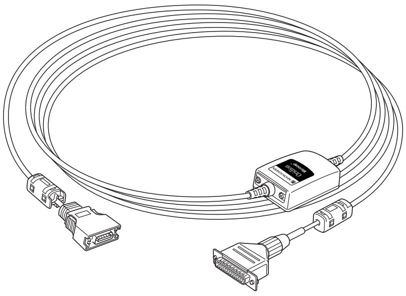
Battery pack (option)
10HR-4/3FAUC-NK


WARNING
CAUTION
AUX
TRIG ECG

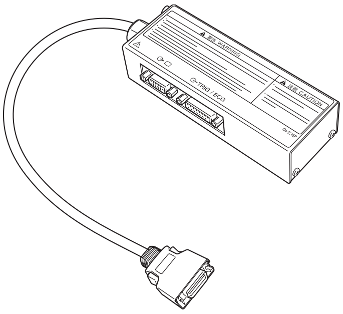
Interface for connecting a display and external instruments (option)
QI-231P



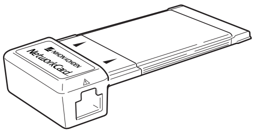
Adapter for attaching QI-231P interface (option)
DI-231P



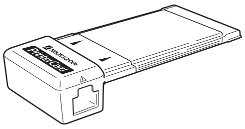
Interface for connecting Oridion Microcap® (option)
QI-235P


WARNING
CAUTION
TRIG / ECG

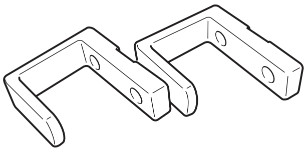
Interface for connecting a display and an external instrument (option)
QI-236P


NetworkCard

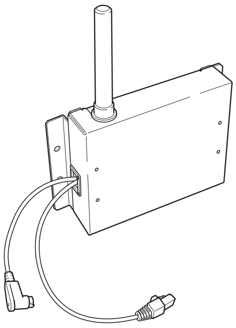
Network Card (option)
QI-101P



Network Printer Card (option)
QI-111P



Hooks (option)
DZ-230P

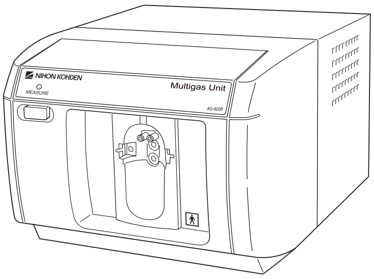


Wireless LAN Station (option)
QI-210P

Cart (option)
KC-013P

BSM-2300 RGB cable (option)
YS-076P2 (10 m)
YS-080P2 (2 m)

Connection cable for optional units
YJ-231P


NIHON KOHDEN
MEASURE
Multigas Unit
AG-920R

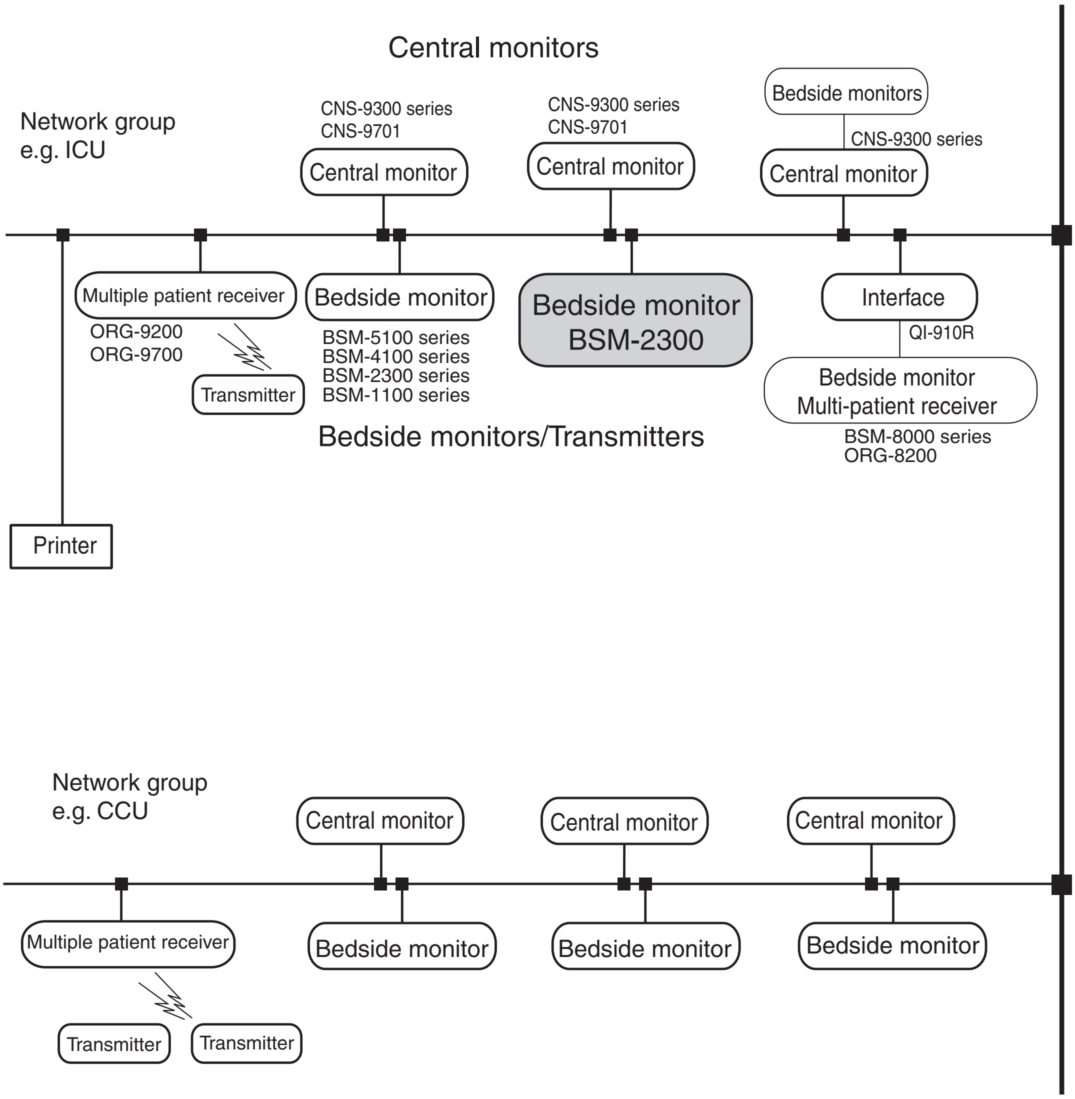
Multigas unit (option)
AG-920R

Network Composition

In a central monitor network, on a central monitor, you can see data of any bed in the network.

The data that can be displayed on the bedside monitor or central monitor depends on the type of bedside or central monitor used.

The number of central monitors and bedside monitors that can be connected to a central monitor network and the network communication method depend on the type of monitor used. For details, refer to the Network and System Installation Guide.

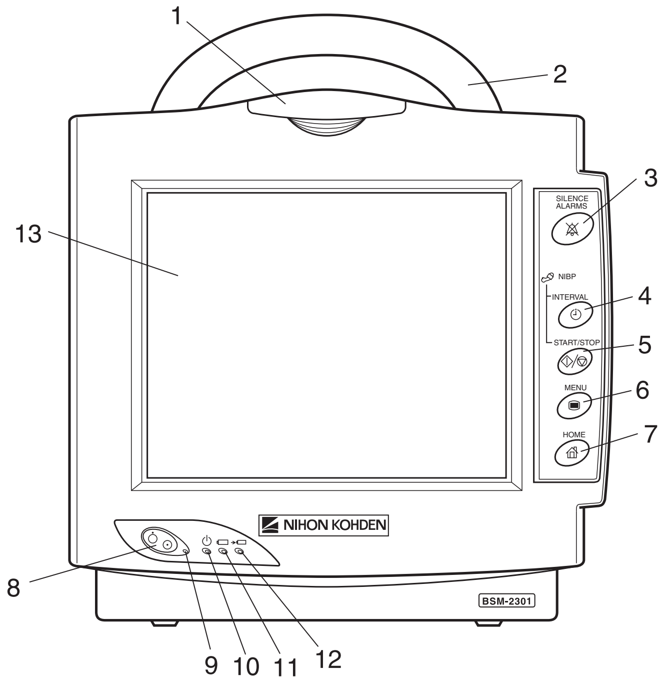

Central monitors
Network group
e.g. ICU
CNS-9300 series
CNS-9701
Central monitor
CNS-9300 series
CNS-9701
Central monitor
Bedside monitors
CNS-9300 series
Central monitor
Multiple patient receiver
ORG-9200
ORG-9700
Transmitter
Bedside monitor
BSM-5100 series
BSM-4100 series
BSM-2300 series
BSM-1100 series
Bedside monitor
BSM-2300
Interface
QI-910R
Bedside monitor
Multi-patient receiver
BSM-8000 series
ORG-8200
Bedside monitors/Transmitters
Printer
Network group
e.g. CCU
Central monitor
Central monitor
Central monitor
Multiple patient receiver
Bedside monitor
Bedside monitor
Bedside monitor
Transmitter
Transmitter

WARNING

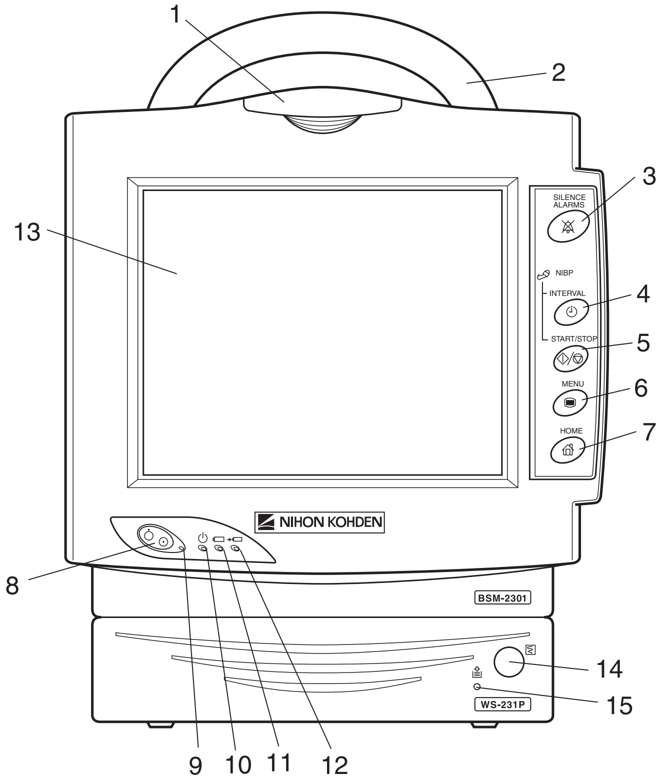
- **Install the printer and hubs outside the patient environment. If they are installed inside the patient environment, the patient or operator may receive electrical shock.**
- **Check the software version number of the monitor before connecting it to the network. Different software versions have different communication methods. When there is more than one communication method in the network, communication may malfunction.**

Panel Description

Front Panel


1
2
3
4
5
6
7
8
9
10
11
12
13
SILENCE ALARMS
NIBP
INTERVAL
START/STOP
MENU
HOME
NIHON KOHDEN
BSM-2301

Without optional WS-231P recorder module


1
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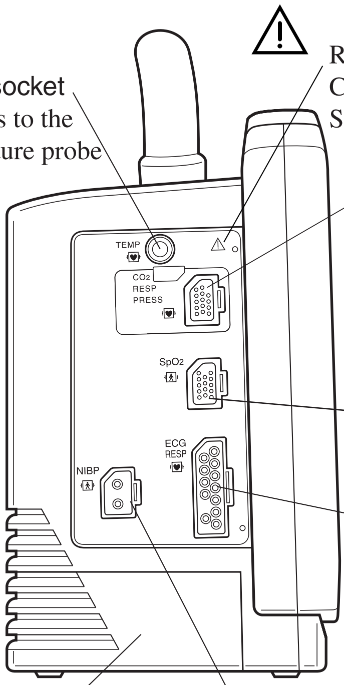
12
13
14
15
SILENCE ALARMS
NIBP
INTERVAL
START/STOP
MENU
HOME
NIHON KOHDEN
BSM-2301
WS-231P

With optional WS-231P recorder module

No.	Name	Description
1	Alarm indicator	Red or yellow lamp blinks according to the alarm settings. Green lamp blinks in synchronization with the patient’s QRS.
2	Handle	For carrying the monitor.
3	SILENCE ALARMS key	Silences the alarm sound.
4	NIBP INTERVAL key	Selects NIBP measurement mode. Pressing this key changes the mode.
5	NIBP START/STOP key	Starts NIBP measurement in selected mode. Pressing the key during measurement stops measurement.
6	MENU key	Displays the MENU window.
7	HOME key	Closes any opened window and displays the monitoring screen.
8	Power switch	Press and hold for more than one second to turn the monitor power on or off.
9	Power lamp	Lights when the monitor power is turned on.
10	AC power lamp	Lights when the power cord is connected between the AC SOURCE socket and AC outlet.
11	Battery power lamp	Lights when operating on the battery power.
12	Battery charging lamp	Lights or slowly blinks when charging.
13	Touch screen	Displays monitoring data. Touching a key or data on the screen changes displaying screen and settings.
14	Record key	Press to start or stop recording.
15	Out of paper lamp	Blinks when out of paper. Lights when recorder door is open.

Left Side Panel

BSM-2301/2351



TEMP socket
Connects to the temperature probe cord.

Refer to Warning and Caution in the "General Safety Information" section.

Multi-parameter socket
Connects to the connection cord of the parameter to be monitored (IBP, CO$_2$ or respiration by thermistor method). The type of parameter is automatically recognized.

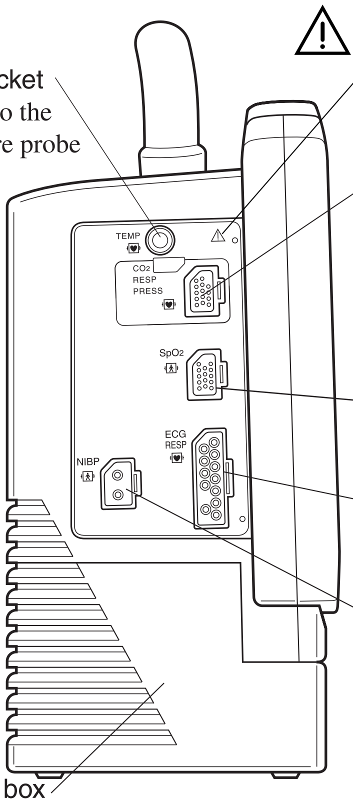
SpO$_2$ socket
Connects to the SpO$_2$ connection cord.

ECG/RESP socket
Connects to the ECG connection cord.

NIBP socket
Connects to the air hose.

Battery box
For the optional battery pack.

Without optional WS-231P recorder module



TEMP socket
Connects to the temperature probe cord.

Refer to Warning and Caution in the "General Safety Information" section.

Multi-parameter socket
Connects to the connection cord of the parameter to be monitored (IBP, CO$_2$ or respiration by thermistor method). The type of parameter is automatically recognized.

SpO$_2$ socket
Connects to the SpO$_2$ connection cord.

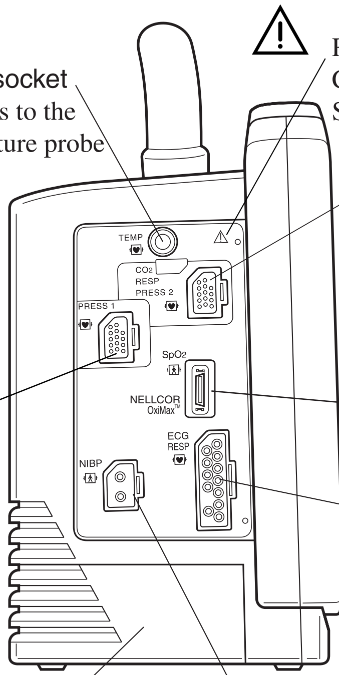
ECG/RESP socket
Connects to the ECG connection cord.

NIBP socket
Connects to the air hose.

Battery box
For the optional battery pack.

With optional WS-231P recorder module

BSM-2304



Refer to Warning and Caution in the "General Safety Information" section.

TEMP socket
Connects to the temperature probe cord.

Multi-parameter socket
Connects to the connection cord of the parameter to be monitored (IBP (PRESS 2), CO_2 or respiration by thermistor method). The type of parameter is automatically recognized.

PRESS 1 socket
Connects to the IBP connection cord.

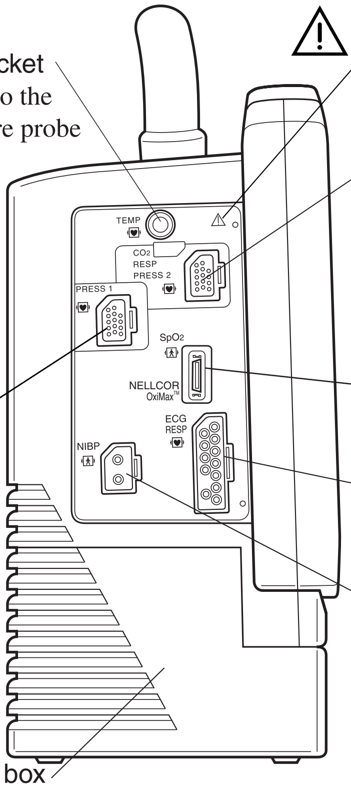
SpO_2 socket
Connects to the SpO_2 connection cord.

ECG/RESP socket
Connects to the ECG connection cord.

NIBP socket
Connects to the air hose.

Battery box
For the optional battery pack.

Without optional WS-231P recorder module



Refer to Warning and Caution in the "General Safety Information" section.

TEMP socket
Connects to the temperature probe cord.

Multi-parameter socket
Connects to the connection cord of the parameter to be monitored (IBP (PRESS 2), CO_2 or respiration by thermistor method). The type of parameter is automatically recognized.

PRESS 1 socket
Connects to the IBP connection cord.

SpO_2 socket
Connects to the SpO_2 connection cord.

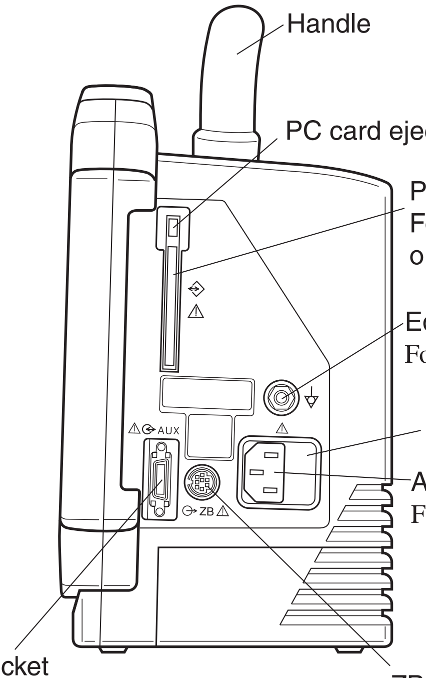
ECG/RESP socket
Connects to the ECG connection cord.

NIBP socket
Connects to the air hose.

Battery box
For the optional battery pack.

With optional WS-231P recorder module

Right Side Panel



Handle

PC card eject button

PC card slot
For an optional QI-101P network card or QI-111P network printer card.

Equipotential grounding terminal
For an equipotential grounding lead.

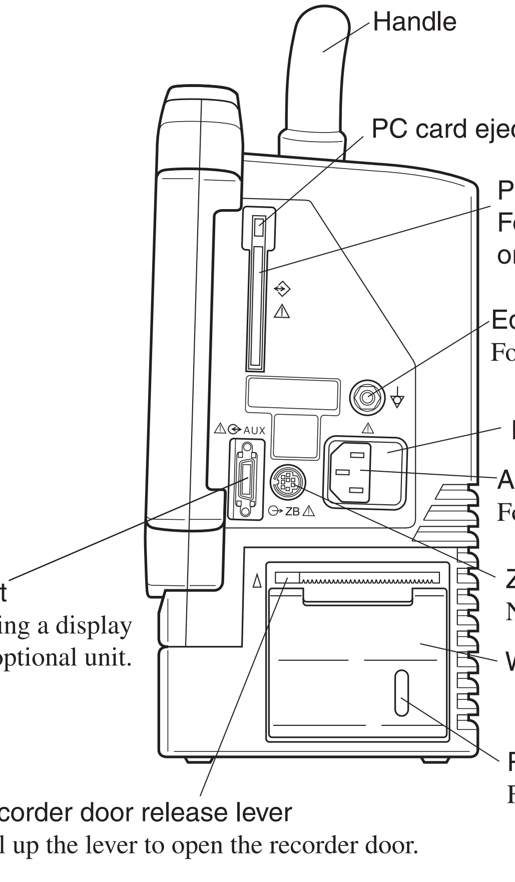
Fuse holder

AC SOURCE power cord socket
For the AC power cord.

AUX socket
For connecting a display monitor or optional unit.

ZB socket
Not available.

Without optional WS-231P recorder module



Handle

PC card eject button

PC card slot
For an optional QI-101P network card or QI-111P network printer card.

Equipotential grounding terminal
For an equipotential grounding lead.

Fuse holder

AC SOURCE power cord socket
For the AC power cord.

AUX socket
For connecting a display monitor or optional unit.

ZB socket
Not available.

WS-231P recorder module (option)

Paper window
For checking the amount of recording paper.

Recorder door release lever
Pull up the lever to open the recorder door.

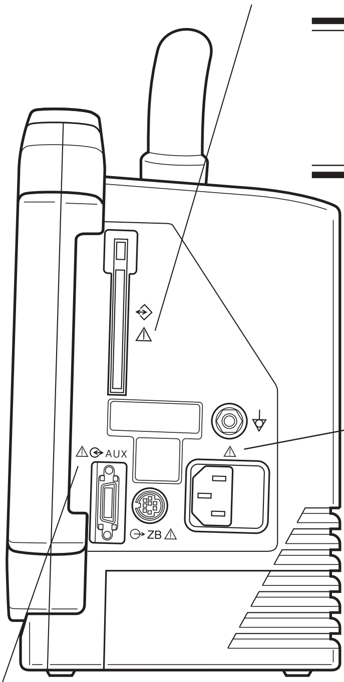
With optional WS-231P recorder module

WARNING

Connect the network as specified. Otherwise patient and operator may get electrical shock or other injury. For connecting the network, contact your Nihon Kohden distributor.

CAUTION

Use only the Nihon Kohden card.



WARNING

- **For patient safety, equipotential grounding of all instruments must be performed. Consult with a qualified biomedical engineer.**
- **Only use the provided power cord. Using other power cords may result in electrical shock or other injury to the patient and operator.**

CAUTION

When the provided power cord cannot be used, operate the monitor on battery power.

WARNING

Connect only the specified instrument to the socket marked with ⚠ by following the specified procedure. Otherwise, electrical leakage current may harm the patient and operator.

CAUTION

When connecting the monitor to other instruments, the connection must comply with IEC 60601-1-1. Refer to "General Requirements for Connecting Medical Electrical System" in Section 19.

Basic Operating Concepts

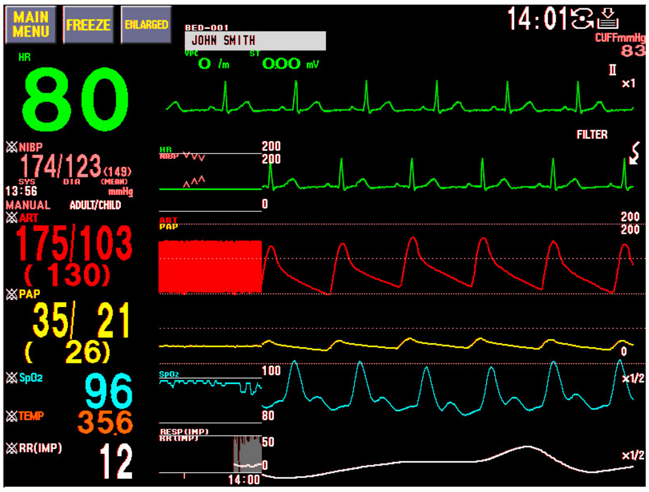
Screen Displays

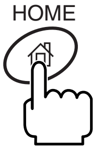
Following are the screens and windows available on the Life Scope i and the Life Scope L bedside monitors. For details about the individual screens and windows, see the appropriate section.

The shadow of the previous screen may remain for a few minutes after changing the screen.

Normally, the monitoring screen is displayed. All screens, except for the SYSTEM SETUP screen, return to the monitoring screen when there is no key operation for about 3 minutes.

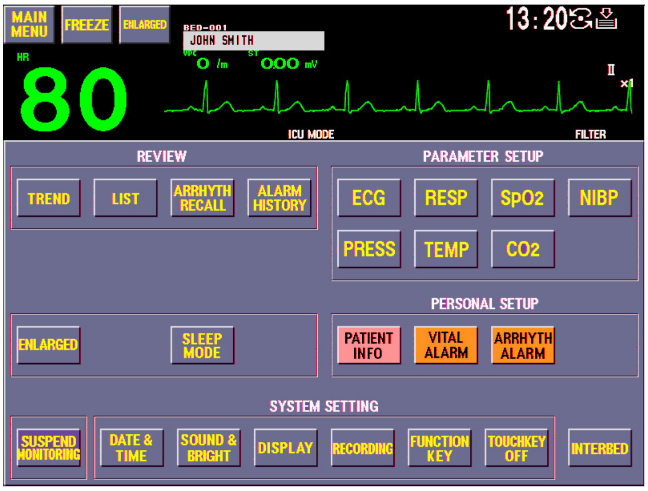
Monitoring screen

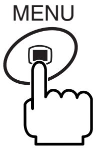

MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
14:01
CUFFmmHg
83
HR
80
VPC
0 /m
ST
0.00 mV
II
×1
FILTER
NIBP
174/123 (149)
SYS DIA (MEAN) mmHg
13:56
MANUAL ADULT/CHILD
ART
175/103
(130)
PAP
35/ 21
(26)
SpO2
96
TEMP
35.6
RR(IMP)
12
HR NIBP
200
200
0
ART PAP
200
200
0
SpO2
100
80
×1/2
RESP(IMP) RR(IMP)
50
0
×1/2
14:00



- The monitoring screen can be displayed anytime by pressing the HOME key on the front panel.
- Displays waveforms and data of the monitoring parameters.
- Touching the patient name displays the PATIENT INFO window for entering patient name.
- Touching the parameter data displays the parameter setting window.

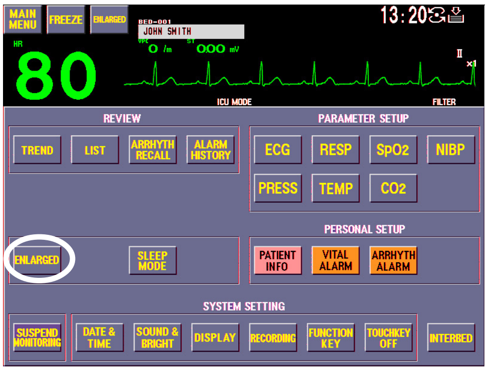
MENU window

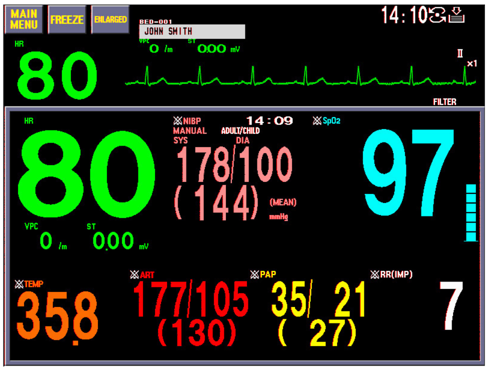

MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC
0 /m
ST
0.00 mV
II
×1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
ENLARGED
SLEEP MODE
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED



The MENU window can be displayed anytime by pressing the MENU key on the front panel. From the MENU window, you can display any window except the monitoring screen.

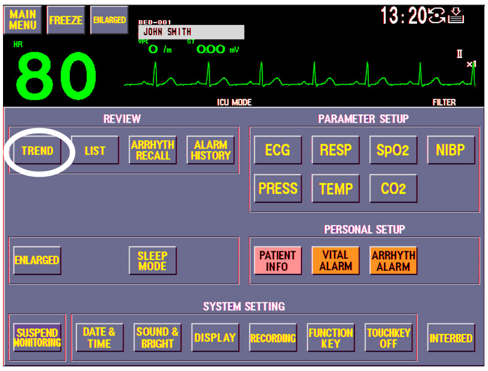
Enlarged window

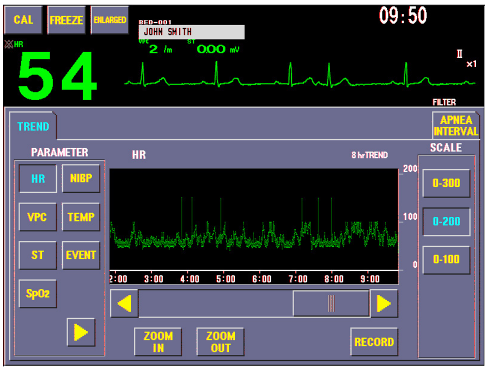

MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC 0 /m
ST 0.00 mV
II
x1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
14:10
HR
80
0 /m
0.00 mV
II
x1
FILTER
HR
80
※NIBP
MANUAL
ADULT/CHILD
14:09
SYS
DIA
178/100
(144)
(MEAN)
mmHg
※SpO2
97
VPC
0 /m
ST
0.00 mV
※TEMP
35.8
※ART
177/105
(130)
※PAP
35/ 21
(27)
※RR(IMP)
7

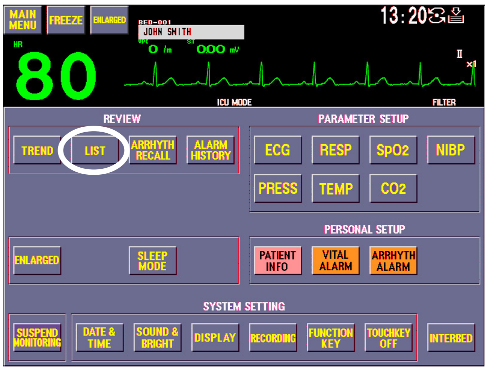
ENLARGED window for displaying enlarged numeric data

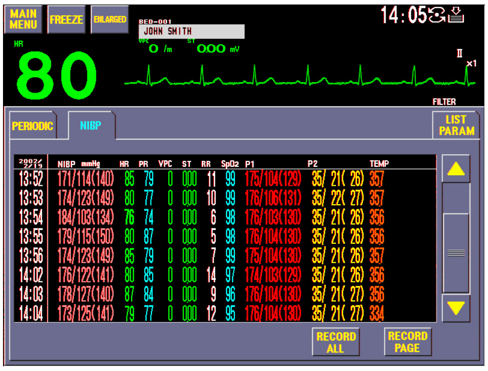
Review windows


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
80
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
09:50
※HR
54
2 /m
0.00 mV
II
x1
FILTER
TREND
APNEA INTERVAL
PARAMETER
HR
8 hr TREND
SCALE
HR
NIBP
VPC
TEMP
ST
EVENT
SpO2
200
100
0
0-300
0-200
0-100
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
ZOOM IN
ZOOM OUT
RECORD

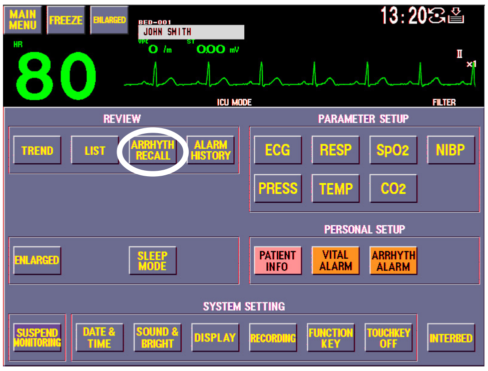
TREND window for displaying 24 hour trendgraph

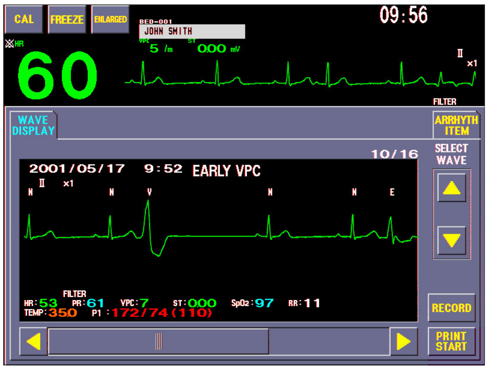

MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
80
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
14:05
HR
80
0 /m
0.00 mV
II
x1
FILTER
PERIODIC
NIBP
LIST PARAM
RECORD ALL
RECORD PAGE

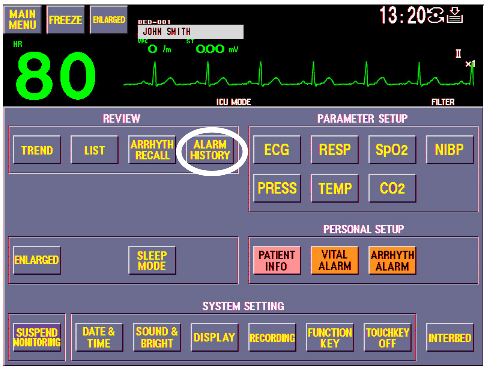
2002/2/19	NIBP mmHg	HR	PR	VPC	ST	RR	SpO2	P1	P2	TEMP
13:52	171/114(140)	85	79	0	0.00	11	99	175/104(129)	35/ 21(26)	35.7
13:53	174/123(149)	80	77	0	0.00	10	99	176/106(131)	35/ 22(27)	35.7
13:54	184/103(134)	76	74	0	0.00	6	98	176/103(130)	35/ 21(26)	35.6
13:55	179/115(150)	80	87	0	0.00	5	98	176/104(130)	35/ 21(26)	35.6
13:56	174/123(149)	85	79	0	0.00	7	99	175/104(130)	35/ 21(26)	35.7
14:02	176/122(141)	80	85	0	0.00	14	97	174/103(129)	35/ 21(26)	35.6
14:03	178/127(140)	87	84	0	0.00	9	96	176/104(130)	35/ 21(27)	35.6
14:04	173/125(141)	79	77	0	0.00	12	95	176/104(130)	35/ 21(27)	33.4

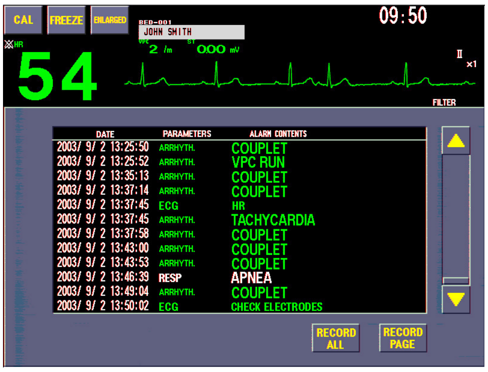
LIST window for displaying list of parameter data


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
80
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
09:56
※HR
60
5 /m
0.00 mV
II
x1
FILTER
WAVE DISPLAY
ARRHYTH ITEM
10/16
SELECT WAVE
2001/05/17 9:52 EARLY VPC
II x1
N N V N N E
FILTER
HR:53 PR:61 VPC:7 ST:0.00 SpO2:97 RR:11
TEMP:35.0 P1:172/74(110)
RECORD
PRINT START

ARRHYTH RECALL window for displaying arrhythmia recall file data

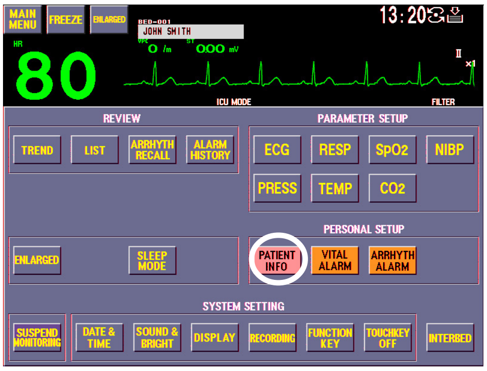

MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC 0 /m
ST 0.00 mV
II
x1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

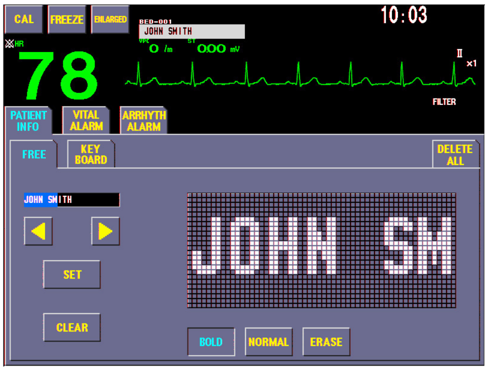

CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
09:50
HR
54
VPC 2 /m
ST 0.00 mV
II
x1
FILTER
RECORD ALL
RECORD PAGE

DATE	PARAMETERS	ALARM CONTENTS
2003/ 9/ 2 13:25:50	ARRHYTH.	COUPLET
2003/ 9/ 2 13:25:52	ARRHYTH.	VPC RUN
2003/ 9/ 2 13:35:13	ARRHYTH.	COUPLET
2003/ 9/ 2 13:37:14	ARRHYTH.	COUPLET
2003/ 9/ 2 13:37:45	ECG	HR
2003/ 9/ 2 13:37:45	ARRHYTH.	TACHYCARDIA
2003/ 9/ 2 13:37:58	ARRHYTH.	COUPLET
2003/ 9/ 2 13:43:00	ARRHYTH.	COUPLET
2003/ 9/ 2 13:43:53	ARRHYTH.	COUPLET
2003/ 9/ 2 13:46:39	RESP	APNEA
2003/ 9/ 2 13:49:04	ARRHYTH.	COUPLET
2003/ 9/ 2 13:50:02	ECG	CHECK ELECTRODES

ALARM HISTORY window for displaying alarm occurrence

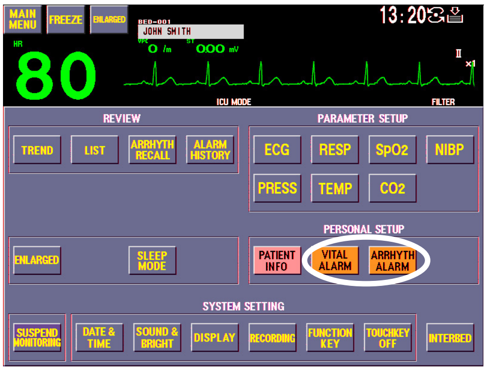
Patient information window

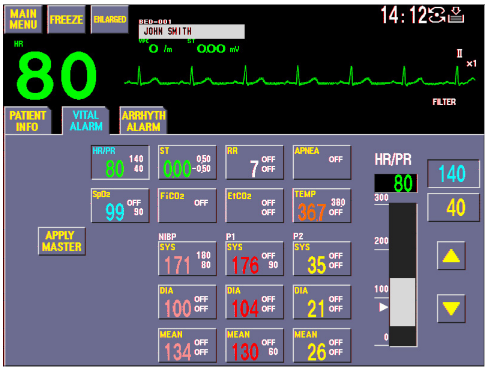

MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC 0 /m
ST 0.00 mV
II
x1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
10:03
HR
78
0 /m
0.00 mV
II
x1
FILTER
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
FREE
KEY BOARD
DELETE ALL
JOHN SMITH
SET
CLEAR
JOHN SM
BOLD
NORMAL
ERASE

PATIENT INFO window for entering patient name. Stored data can be deleted on this window.

Alarm setting window

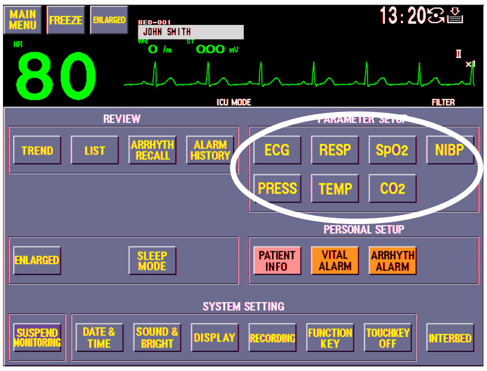

MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC 0 /m
ST 0.00 mV
II
x1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

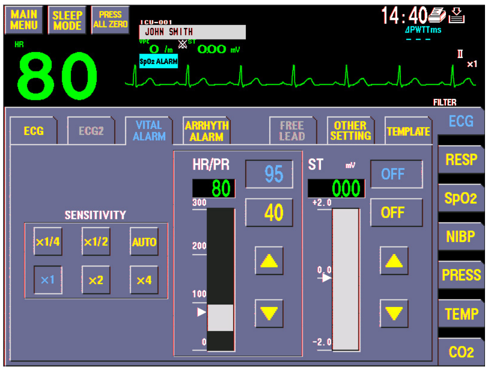

MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
14:12
HR
80
0 /m
0.00 mV
II
x1
FILTER
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
HR/PR 80 140 40
ST 0.00 0.50 -0.50
RR 7 OFF OFF
APNEA OFF
SpO2 99 OFF 90
FiCO2 OFF
EtCO2 OFF OFF
TEMP 36.7 38.0 OFF
APPLY MASTER
NIBP SYS 171 180 80
P1 SYS 176 OFF 90
P2 SYS 35 OFF OFF
DIA 100 OFF OFF
DIA 104 OFF OFF
DIA 21 OFF OFF
MEAN 134 OFF OFF
MEAN 130 OFF 60
MEAN 26 OFF OFF
HR/PR
80
140
40
300
200
100
0

VITAL ALARM window for setting vital signs alarm and ARRHYTH ALARM window for setting arrhythmia alarms

Parameter setting windows

For changing parameter monitoring settings

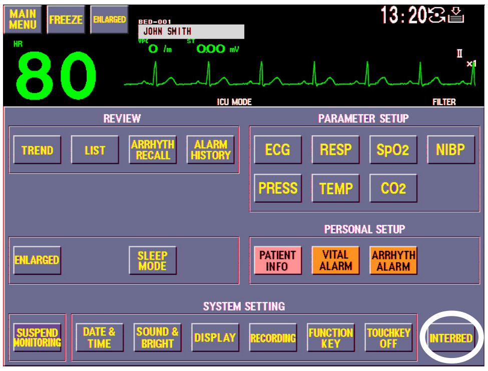

MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC 0 /m
ST 0.00 mV
II
x1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

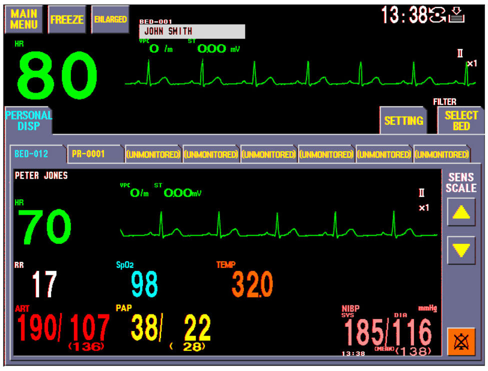

MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
14:40
dPWTms
HR
80
0 /m
0.00 mV
SpO2 ALARM
II
x1
FILTER
ECG
ECG2
VITAL ALARM
ARRHYTH ALARM
FREE LEAD
OTHER SETTING
TEMPLATE
SENSITIVITY
x1/4
x1/2
AUTO
x1
x2
x4
HR/PR
95
80
40
300
200
100
0
ST mV
OFF
0.00
OFF
+2.0
0.0
-2.0
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2

ECG window

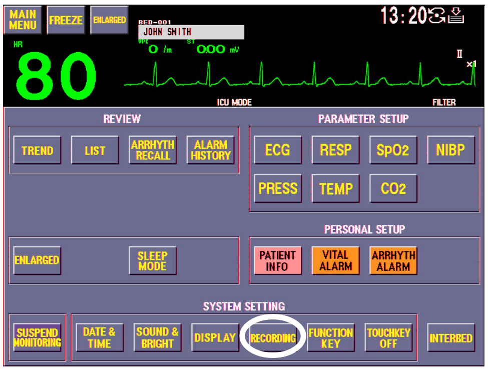
INTERBED window

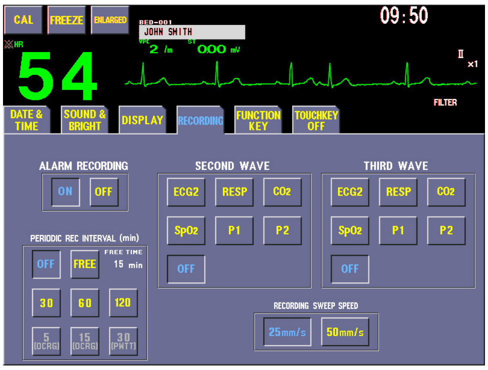
For selecting interbed beds and displaying interbed bed data when the monitor is connected to a network


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC 0 /m
ST 000 mV
II
x1
ICU MODE
FILTER
REVIEW
PARAMETER SETUP
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

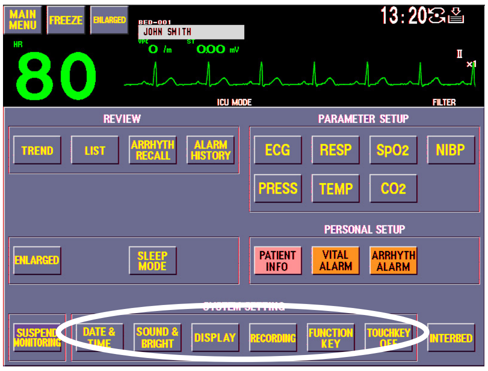

MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:38
HR
80
VPC 0 /m
ST 000 mV
II
x1
FILTER
PERSONAL DISP
SETTING
SELECT BED
BED-012
PR-0001
(UNMONITORED)
(UNMONITORED)
(UNMONITORED)
(UNMONITORED)
(UNMONITORED)
(UNMONITORED)
PETER JONES
SENS SCALE
VPC 0/m
ST 000mV
II
x1
HR
70
RR
17
SpO2
98
TEMP
320
ART
190/107
(136)
PAP
38/22
(28)
NIBP
SYS
DIA
mmHg
185/116
(MEAN)
(138)
13:38

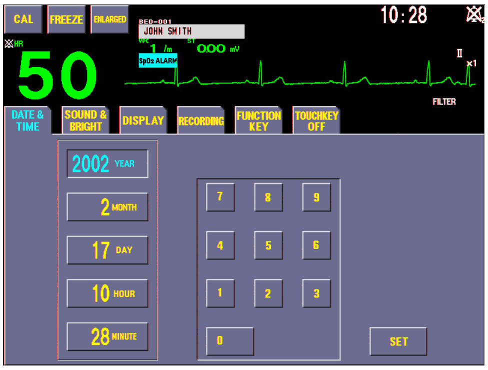
Setup and other windows


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC 0 /m
ST 000 mV
II
x1
ICU MODE
FILTER
REVIEW
PARAMETER SETUP
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

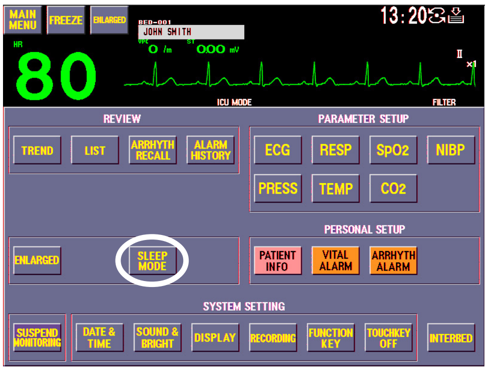

CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
09:50
HR
54
VPC 2 /m
ST 000 mV
II
x1
FILTER
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
ALARM RECORDING
ON
OFF
SECOND WAVE
ECG2
RESP
CO2
SpO2
P1
P2
THIRD WAVE
ECG2
RESP
CO2
SpO2
P1
P2
PERIODIC REC INTERVAL (min)
OFF
FREE
FREE TIME 15 min
OFF
OFF
30
60
120
5 (DCRG)
15 (DCRG)
30 (PHTT)
RECORDING SWEEP SPEED
25mm/s
50mm/s

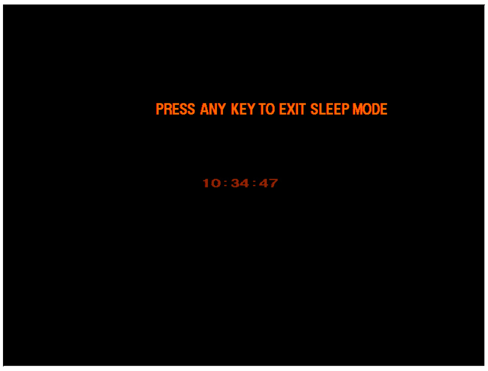
RECORDING window for recording setting


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC 0 /m
ST 000 mV
II
x1
ICU MODE
FILTER
REVIEW
PARAMETER SETUP
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
10:28
HR
50
VPC 1 /m
ST 000 mV
SpO2 ALARM
II
x1
FILTER
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
2002 YEAR
2 MONTH
17 DAY
10 HOUR
28 MINUTE
7
8
9
4
5
6
1
2
3
0
SET

DATE & TIME window for changing date and time, SOUND & BRIGHT window for changing alarm and sync sound volume and screen brightness, DISPLAY window for changing trendgraph display on the monitoring screen and respiration/ CO_2 waveform sweep speed, FUNCTION KEY window for assigning a function to a function key and TOUCHKEY OFF window for turning touch screen function off


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC 0 /m
ST 000 mV
II
x1
ICU MODE
FILTER
REVIEW
PARAMETER SETUP
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

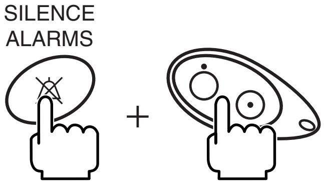


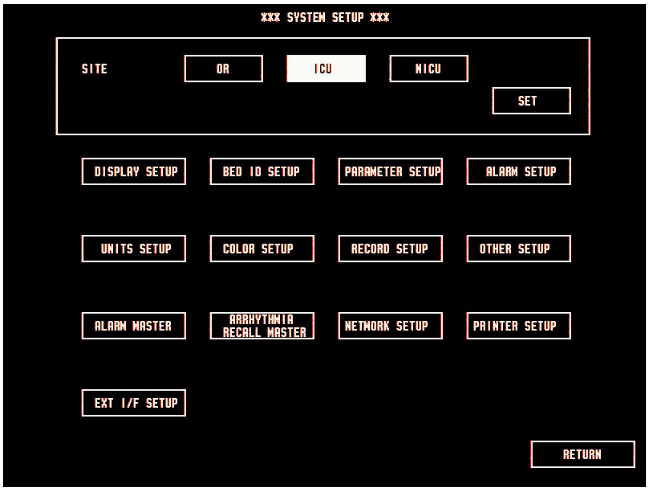
PRESS ANY KEY TO EXIT SLEEP MODE

10:34:47

SLEEP MODE window for turning sleep mode on

SYSTEM SETUP screen

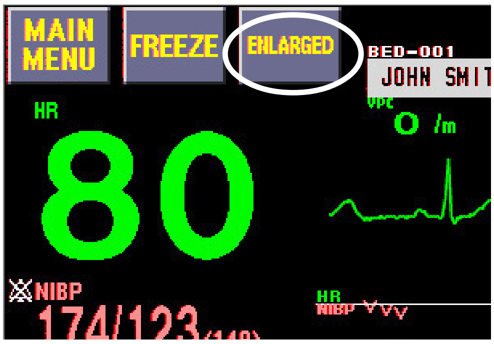

SILENCE
ALARMS
+


*** SYSTEM SETUP ***
SITE
OR
ICU
NICU
SET
DISPLAY SETUP
BED ID SETUP
PARAMETER SETUP
ALARM SETUP
UNITS SETUP
COLOR SETUP
RECORD SETUP
OTHER SETUP
ALARM MASTER
ARRHYTHMIA RECALL MASTER
NETWORK SETUP
PRINTER SETUP
EXT I/F SETUP
RETURN

For changing system settings. Displaying the SYSTEM SETUP screen interrupts monitoring.

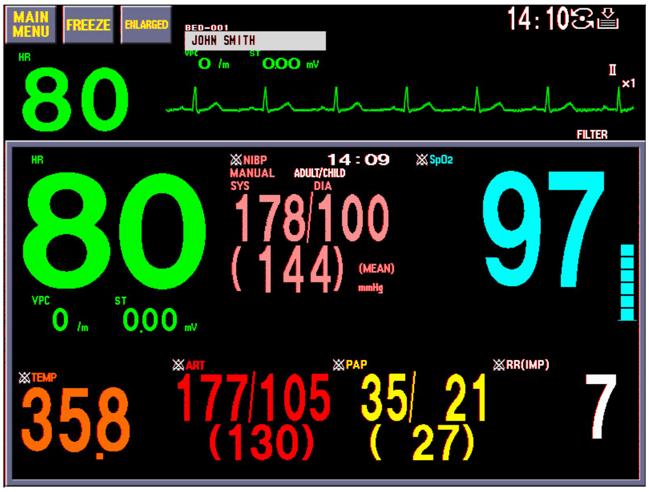
Using Touch Screen Keys

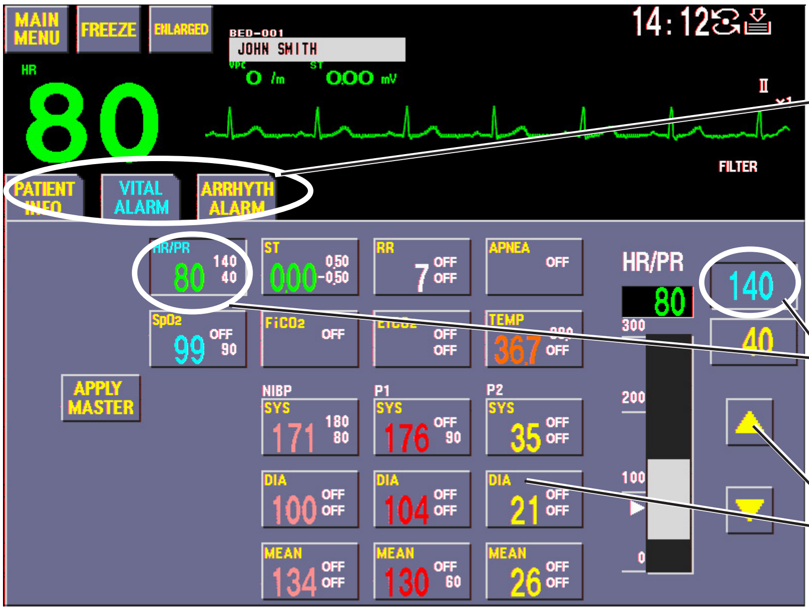
Any window can be opened and settings can be changed by touching the keys and items on the screen with your finger or the touch pen (option).


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMIT
HR
80
VPC
0 /m
NIBP
174/123

Touching the key on the screen displays the window.

⇨

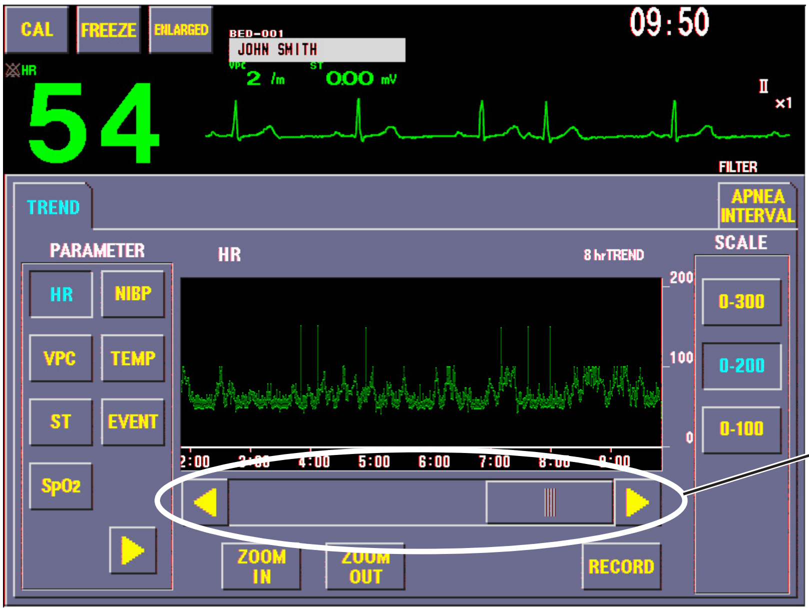

MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
14:10
HR
80
NIBP
MANUAL
14:09
SpO2
178/100
(144)
97
TEMP
358
ART
177/105
(130)
PAP
35/ 21
(27)
RR(IMP)
7


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
14:12
HR
80
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
HR/PR
ST
RR
APNEA
SpO2
FiCO2
EtCO2
TEMP
APPLY MASTER
NIBP
P1
P2
SYS
DIA
MEAN
140
40
FILTER

Tabs for changing displaying window. The opened window is displayed in light blue.

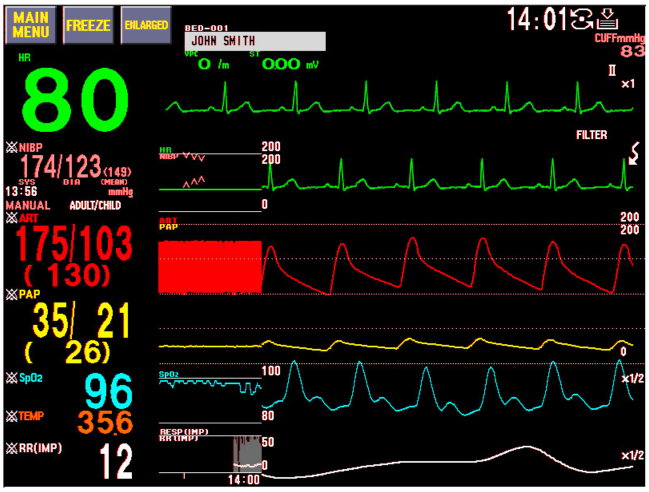
Selected item is displayed in light blue

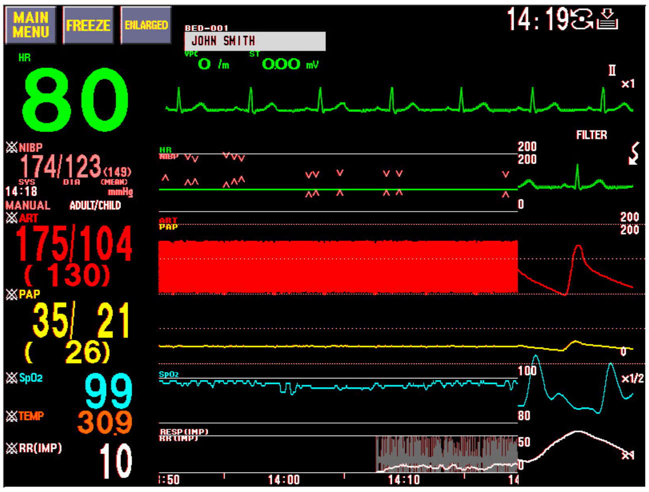
Selectable items or keys are displayed in yellow


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
09:50
HR
54
FILTER
TREND
APNEA INTERVAL
PARAMETER
HR
8 hr TREND
SCALE
NIBP
VPC
TEMP
ST
EVENT
SpO2
0-300
0-200
0-100
ZOOM IN
ZOOM OUT
RECORD

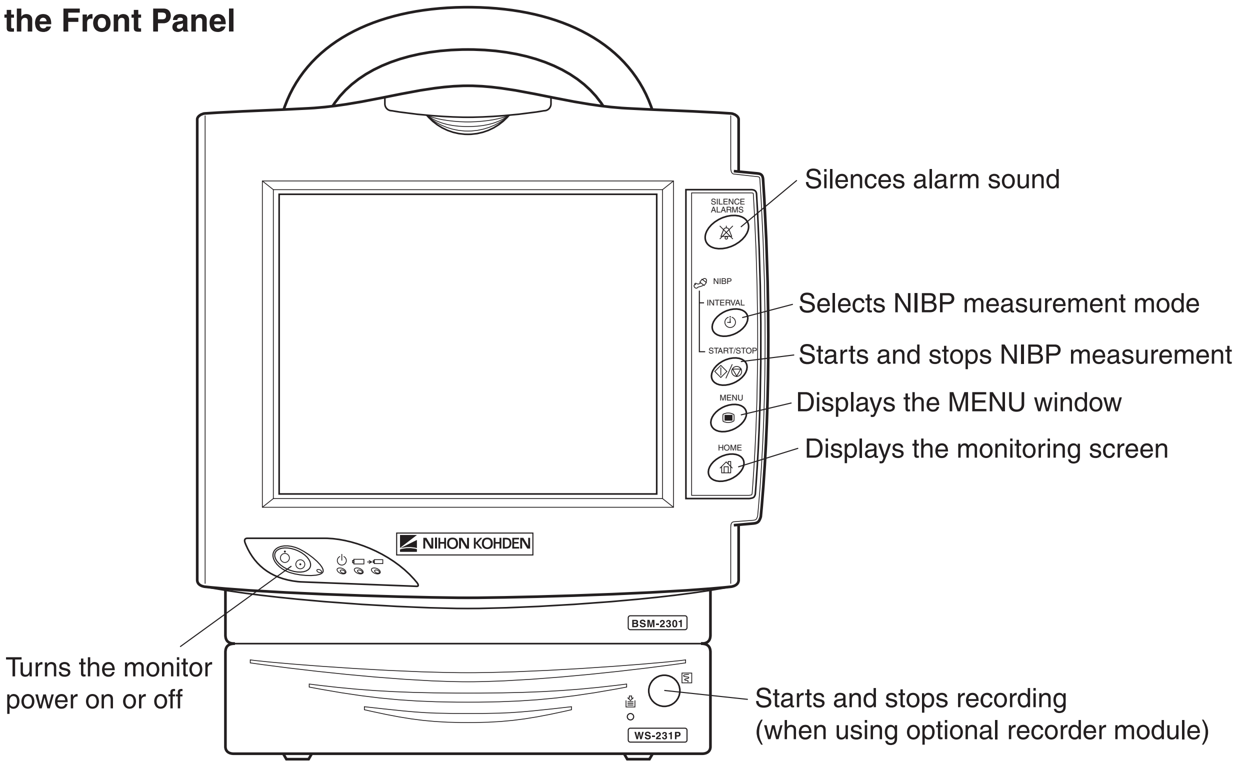
Scroll bar and buttons for scrolling data

The time width of the trendgraph on the monitoring screen can be adjusted by touching the position for the right edge of the trendgraph on the screen.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
14:01
HR
80
NIBP
174/123 (149)
ART
175/103
(130)
PAP
35/ 21
(26)
SpO2
96
TEMP
35.6
RR(IMP)
12
14:00


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
14:19
HR
80
NIBP
174/123 (149)
ART
175/104
(130)
PAP
35/ 21
(26)
SpO2
99
TEMP
30.9
RR(IMP)
10
14:00
14:10

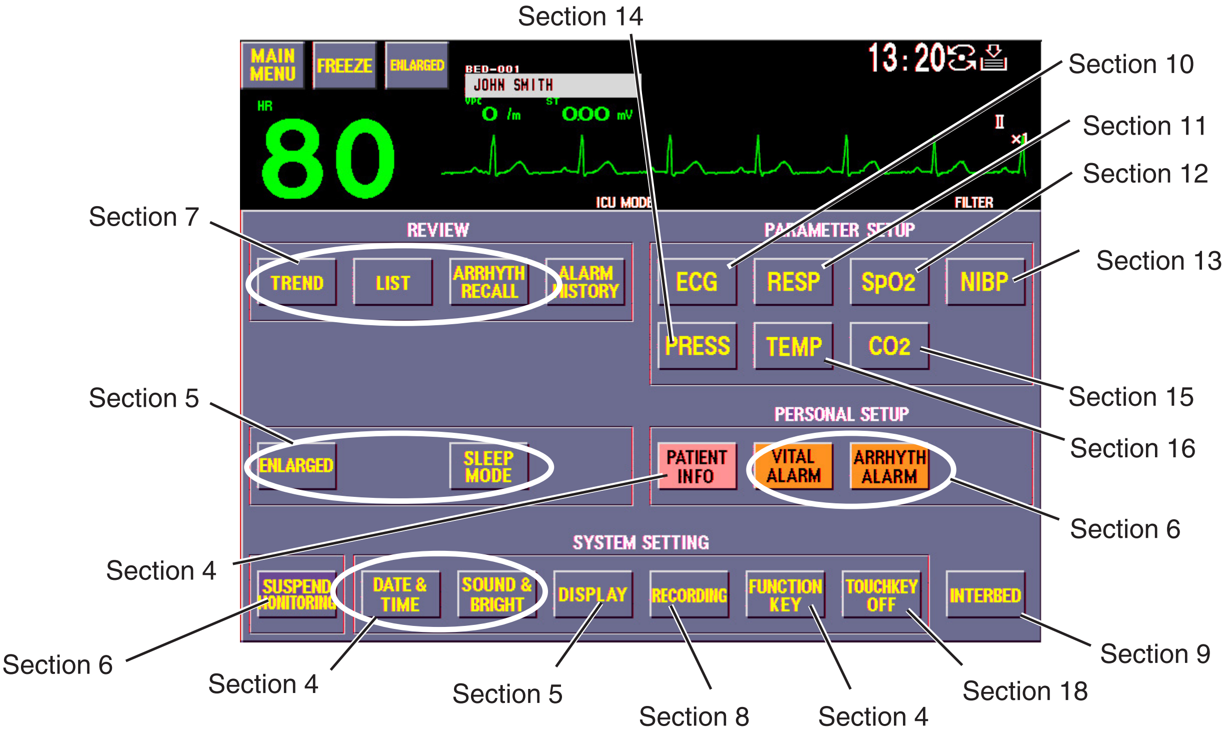
Keys on the Front Panel


Silences alarm sound
Selects NIBP measurement mode
Starts and stops NIBP measurement
Displays the MENU window
Displays the monitoring screen
Turns the monitor power on or off
Starts and stops recording (when using optional recorder module)
SILENCE ALARMS
NIBP
INTERVAL
START/STOP
MENU
HOME
NIHON KOHDEN
BSM-2301
WS-231P

Using the MENU Window

The MENU window can be displayed anytime by pressing the MENU key on the front panel. From the MENU window, you can display any window except the monitoring screen.

For details on each window, refer to the section specified below.


Section 14
Section 10
Section 11
Section 12
Section 13
Section 7
Section 5
Section 15
Section 16
Section 6
Section 4
Section 9
Section 6
Section 4
Section 5
Section 8
Section 4
Section 18
MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC
0 /m
ST
0.00 mV
II
×1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
ENLARGED
SLEEP MODE
PERSONAL SETUP
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

General Safety Information

General

WARNING

- **Never use this monitor in the presence of any flammable anesthetic gas, concentrated oxygen or hyperbaric oxygen. Failure to follow this warning may result in explosion.**
- **Never use the monitor in a high-pressure oxygen medical care tank. Failure to follow this warning may cause explosion or fire.**
- **When using this monitor with an electrosurgery unit, its return plate and the electrodes for monitoring must be firmly attached to the patient. If the return plate is not attached correctly, it may burn the patient's skin where the electrodes are attached. Refer to the instruction manual for the ESU.**
- **When performing MRI tests, remove the electrodes and transducers connected to the patient from this monitor. The heat generated from the induced electromotive force may burn the patient's skin. For details, refer to the instruction manual for the MRI.**
- **When performing defibrillation, discharge as far as possible from electrodes and medicine on the chest of the patient. If there is a possibility that the defibrillator paddle could touch electrodes and medicine, remove electrodes and medicine from the patient. If the defibrillator directly contacts these materials, the discharged energy may cause serious electrical burn to the patient.**
- **Before performing defibrillation, check that the cords and cables of the electrodes and transducers attached to the patient are properly connected to the monitor. Touching the metal parts of disconnected cords and cables may cause serious electrical shock or injury by discharged energy.**
- **To avoid the risk of serious electrical burn, shock or other injury during defibrillation, all persons must keep clear of the bed and must not touch the patient or any equipment connected to the patient.**
- **During alarm suspension (the "ALARMS SUSPENDED" or "ALL ALARMS OFF" message displayed), all current alarms are temporarily turned off.**
- **Before setting ALARMS OFF TYPE, consult the administrator of this monitor in your facility. Before selecting "ALL ALARMS OFF" or "BYPASS", all operators must thoroughly understand the function of the "ALL ALARMS OFF" key and "BYPASS" key which turn all alarms off for an indefinite period.**
- **Do not turn all alarms off with the ALL ALARMS OFF key when there is no medical staff around the patient or when the patient is connected to a ventilator.**
- **Do not turn all alarms off with the BYPASS key when there is no medical staff around the patient.**
- **When EXIT SLEEP MODE ON ALARM on the SYSTEM SETUP screen is set NO, the bedside monitor alarm cannot be seen or heard on the bedside monitor during sleep mode. Monitor the bedside monitor**

alarm on the central monitor or telemetry system. Otherwise, the bedside monitor alarm may be overlooked.
- **For arrhythmia monitoring, set ARRHYTHMIA ANALYSIS on the ECG window to ON. Otherwise, there is no sound or indication for arrhythmia alarms.**
- **When admitting a new patient, check the alarm settings. The alarm settings return to the alarm master settings on the SYSTEM SETUP screen when all data is deleted on the DELETE ALL window or 30 minutes elapse after monitor power off.**

CAUTION

- **Use only Nihon Kohden specified electrodes, probes, transducers, thermistors and catheters. Otherwise, the maximum performance from the monitor cannot be guaranteed.**
- **Do not reuse disposable parts.**
- **Turn off the power of cell telephones, small wireless devices and other devices which produce strong electromagnetic interference. Otherwise, the waveforms and measurements are affected by such interference and the displayed data may be incorrect.**
- **When admitting a new patient, first delete all data of the previous patient. Otherwise, the data of the previous patient and new patient will be mixed together.**
- **After the monitor power is turned on, parameter-related alarms do not function until the parameters are monitored (during standby mode).**
- **Alarm recording is not performed when alarm is suspended or alarm recording is set to off.**
- **If there is any doubt about the arrhythmia analysis, make the monitor relearn the patient's VPC. Otherwise, an important arrhythmia maybe overlooked.**
- **When the upper or lower alarm limit is turned off, there will be no upper or lower alarm for that parameter limit.**
- **When the "CONNECTOR OFF" message appears on the screen, check that the connection cords are connected to the sockets properly. Patient cannot be monitored and the alarm does not function properly while this message is displayed.**
- **Do not turn the monitor off when the system check screen is displayed. Otherwise the saved data may be damaged or deleted. If the monitor is turned off during system check, delete all data because the data is not reliable.**
- **If fluids are accidentally spilled on the monitor, take the bedside monitor out of service and check for damage.**

Installation

WARNING

- **For patient safety, equipotential grounding of all instruments must be**

performed. Consult with a qualified biomedical engineer.

- **Only use the provided power cord. Using other power cords may result in electrical shock or other injury to the patient and operator.**
- **When the provided power cord cannot be used or when equipotential grounding is doubtful (such as in poor grounding facility), operate the monitor on battery power.**
- **Connect only the specified instrument to the socket marked with ⚠ by following the specified procedure. Otherwise, electrical leakage current may harm the patient and operator.**

CAUTION

- **When connecting the monitor to other instruments, the connection must comply with IEC 60601-1-1. Refer to "General Requirements for Connecting Medical Electrical System" in Section 19.**
- **Disconnect the power cord from the AC socket before connecting the instruments.**
- **Use only the KC-013P cart for the BSM-2300 bedside monitor. If another cart is used, it may tip over or the monitor may fall off.**
- **Avoid locations where the monitor and system may be sprinkled with water or chemical solutions. Otherwise the monitor and system may be damaged.**
- **When not using the KC-013P cart, make sure that the monitor is placed and fastened so that it does not tip over.**
- **Install the monitor and ESU appropriately and perform equipotential grounding. Otherwise, noise from the ESU may interfere with the ECG and ECG monitoring may not be performed properly.**
- **At the monitor on, check that one "bong" sounds and the red alarm lamp, yellow lamp and green lamp blink once to show that the alarm functions properly.**

Also read the warning and caution in "Selecting a Suitable Location" in Section 2.

Using QI-231P/236P Interface

WARNING

If the display does not have an equipotential ground terminal and the bedside monitor and display cannot be equipotentially grounded, make sure that the display is grounded to the same AC outlet as the bedside monitor. Always perform equipotential grounding as specified in IEC 60601-1-1 when required.

CAUTION

- **Before connecting instruments, make sure that the power is turned off. Otherwise electrical current may harm the patient and operator.**

However, when using the TRIG output, before connecting the instrument to the interface, connect the interface cable to the monitor, display the monitoring screen on the monitor and check that the TRIG LED on the interface is lit. (Only QI-231P interface has the TRIG LED.)

- **Keep the interface and cable out of the way. Otherwise people may trip over it, causing the cable to break or the bedside monitor to fall and injure the patient and operator.**
- **When using the output signal from the interface as the synchronization signal for other equipment such as IABP (intra-aortic balloon pump), or defibrillator:**
  - **Set the timing of the other equipment by checking the waveform on the screen of the equipment.**
  - **Check the condition of the bedside monitor at all times. The output signal may become unstable.**
  - **Check that the delay time of the output signal (QRS sync 100 ms (QI-231P) / 20 ms (QI-236P) maximum, ECG analog 20 ms maximum) is within the range of the connected equipment.**
  - **Do not use the QRS sync signal as the synchronization signal for a defibrillator.**
- **Only use the DI-231P adapter for attaching the interface to the monitor.**

Using DZ-230P Hooks

CAUTION

- **Use the hooks only for hooking the BSM-2300 series bedside monitors onto a board.**
- **Do not carry the monitor by the hooks.**
- **Hook the monitor onto a board which can support the weight of the monitor.**
- **To prevent the monitor from falling off, periodically check that the hooks are attached to the monitor properly.**
- **Do not put weight on the hooks and monitor.**
- **Make sure that both hooks are properly hooked onto the board.**
- **When moving a bed with a monitor hooked to it, make sure that the monitor does not fall off.**

Network

WARNING

- **Install the printer and hubs outside the patient environment. If they are installed inside the patient environment, the patient or operator may receive electrical shock.**

- **Connect the network as specified. Otherwise patient and operator may get electrical shock or other injury. For connecting the network, contact your Nihon Kohden distributor.**
- **Do not use the damaged network cable. Otherwise patient or operator may get an electrical shock when the damaged part is touched.**
- **Check the software version number of the monitor before connecting it to the network. Different software versions have different communication methods. When there is more than one communication method in the network, communication may malfunction.**

CAUTION

- **The network must be managed by the network administrator. Make sure that each monitor in the network has a different IP address. Otherwise, data communication cannot be performed properly. When adding a unit to an already operating network, set the IP address on the monitor before connecting the monitor to the network.**
- **Use only the Nihon Kohden network card.**
- **Do not push in the network cable with too much force. Otherwise the network card or bedside monitor may get damaged.**
- **When the monitor is connected to a central monitor network, set the Bed Name (Bed ID) and Group Name on the monitor. Otherwise, the default settings are used for the bed name and group name and the bed may be incorrectly identified on the central monitor.**

Battery

WARNING

- **Keep the battery pack away from fire. The battery pack may explode.**
- **Do not heat the battery pack. The battery pack may explode.**
- **Never short-circuit the + and – terminals on the battery pack with a wire or store the battery pack with metals such as necklace or hair pins. The battery pack may short-circuit, causing the substance inside the battery to leak or explode.**
- **Never disassemble or modify the battery pack. Never damage or directly solder the sheath tube. The battery pack short-circuits, the electrolyte comes out and the battery pack explodes.**
- **Do not subject the battery pack to a strong mechanical shock. The battery may leak or explode.**
- **Do not use a battery which is damaged, such as from falling. There is a gas discharge valve inside the battery and if this valve is damaged, the gas cannot be discharged, causing the battery to explode.**
- **Only use the battery pack on the specified instrument. If the battery**

is used on an unspecified instrument, large current may flow, causing the battery to explode.

- **If the battery pack is damaged and the substance inside the battery (alkaline liquid) contacts the eyes or skin, wash immediately and thoroughly with water and see your physician. Never rub your eyes, otherwise you may lose your eyesight.**
- **The battery pack has + and – polarity. Make sure that the battery is installed with the correct polarity direction. Otherwise, the substance inside the battery may leak and explode.**
- **Do not connect the battery pack to an AC outlet or lighter socket in a car. The battery may explode.**
- **Do not immerse the battery pack in water or seawater. The battery will rust and may heat up.**
- **Never use a battery pack which is damaged, discolored or has leakage. A damaged battery may explode if used.**
- **Do not leave the battery for more than two years unused. The battery may leak.**

CAUTION

- **Do not expose the battery pack to direct sunlight or leave in a high temperature place. The lifetime of the battery pack may be shortened or the substance inside the battery pack may leak.**
- **Do not leave a used battery pack for a long period of time (more than one year). The substance inside the battery may leak.**
- **The battery pack must be replaced by qualified service personnel.**
- **Keep the battery pack away from children.**
- **Before disposing of the battery, check with your local solid waste officials for details in your area for recycling options or proper disposal. The battery is recycleable. At the end of its useful life, under various state and local laws, it may be illegal to dispose of this battery into the municipal waste stream.**

ECG Monitoring

WARNING

Interaction Between Minute Ventilation Rate-Adaptive Pacemakers and Cardiac Monitoring and Diagnostic Equipment*

The bioelectric impedance measurement sensor of a minute ventilation rate-adaptive implantable pacemaker may be affected by cardiac monitoring and diagnostic equipment which is connected to the same patient. If this occurs, the pacemaker may pace at its maximum rate and give incorrect data to the monitor or diagnostic equipment. If this occurs, disconnect the monitor or diagnostic equipment from the patient or change the setting on the pacemaker by referring to the

pacemaker's manual. For more details, contact your pacemaker distributor or Nihon Kohden distributor.

* Minute ventilation is sensed in rate-adaptive pacemakers by a technology known as bioelectric impedance measurement (BIM). Many medical devices in addition to pacemakers use this technology. When one of these devices is used on a patient with an active, minute ventilation rate-adaptive pacemaker, the pacemaker may erroneously interpret the mixture of BIM signals created in the patient, resulting in an elevated pacing rate.
For more information, see the FDA web site.
http://www.fda.gov/cdrh/safety.html

WARNING

- **When using a defibrillator together with the monitor, use Ag/AgCl electrodes. Other types of electrodes, stainless steel in particular, will adversely affect the ECG waveform by slowing the baseline recovery on the monitor and result in no monitoring immediately following defibrillation.**
- **False heart rate indicators may occur with certain pacemakers because of electrical overshoots.**
- **Pacemaker patients can only be monitored when the pace program is activated.**
- **Keep pacemaker patients under close observation. The pacemaker rate may be counted during cardiac arrest and certain arrhythmias. Do not rely only on the monitor.**
- **For arrhythmia monitoring, set ARRHYTHMIA ANALYSIS on the ECG window to ON. Otherwise, there is no sound or indication for arrhythmia alarms.**

CAUTION

- **Use only Nihon Kohden products and specified parts and accessories. When other type of electrodes are used, the "CHECK ELECTRODES" message may be displayed and monitoring may stop.**
- **Do not reuse disposable electrodes.**
- **If the contact is bad even before the expiration date printed on the package, replace the electrode with a new one.**
- **When the "CHECK ELECTRODES" message is displayed, ECG is not monitored properly. Check the electrode, electrode leads and connection cord, and if necessary, replace it with a new one.**
- **When using the monitor with an ESU, locate the monitor and ESU following the description in "Use with an Electrosurgical Unit" in Section 10 and ground the instruments properly. Otherwise noise from the ESU may interfere with the ECG and the heart rate and arrhythmia analysis may be incorrect.**
- **At the start of ECG monitoring, check that the dominant QRS is**

appropriate. Otherwise arrhythmia monitoring may be inaccurate.
- **If there is any doubt about the arrhythmia analysis, make the monitor relearn the patient's VPC and check that the dominant QRS is appropriate. Otherwise, arrhythmia monitoring may not be accurate.**
- **Changing the dominant QRS must be performed under the physician's instructions.**
- **When the alarm is turned OFF for an arrhythmia, there will be no alarm for that arrhythmia type.**
- **Turn the pacing spike detection to On when monitoring a pacemaker patient. Otherwise QRS and pacemaker spike may not be distinguished and pacemaker failure may not be recognized.**

Respiration Monitoring

WARNING

Interaction Between Minute Ventilation Rate-Adaptive Pacemakers and Cardiac Monitoring and Diagnostic Equipment*
The bioelectric impedance measurement sensor of a minute ventilation rate-adaptive implantable pacemaker may be affected by cardiac monitoring and diagnostic equipment which is connected to the same patient. If this occurs, the pacemaker may pace at its maximum rate and give incorrect data to the monitor or diagnostic equipment. If this occurs, disconnect the monitor or diagnostic equipment from the patient or change the setting on the pacemaker by referring to the pacemaker's manual. For more details, contact your pacemaker distributor or Nihon Kohden distributor.

* Minute ventilation is sensed in rate-adaptive pacemakers by a technology known as bioelectric impedance measurement (BIM). Many medical devices in addition to pacemakers use this technology. When one of these devices is used on a patient with an active, minute ventilation rate-adaptive pacemaker, the pacemaker may erroneously interpret the mixture of BIM signals created in the patient, resulting in an elevated pacing rate.
For more information, see the FDA web site.
http://www.fda.gov/cdrh/safety.html

SpO_2 Monitoring

WARNING

- **Measurement may be incorrect in the following cases.**
  - **When the patient's carboxyhemoglobin or methemoglobin increases abnormally.**
  - **When dye is injected in the blood.**
  - **When using an electrical surgery unit.**

- **During CPR.**
- **When there is body movement.**
- **When there is vibration.**
- **When measuring at a site with venous pulse.**
- **When the pulse wave is small (insufficient peripheral circulation).**
- **When using an IABP (intra-aortic balloon pump).**

- **Check the circulation condition by observing the skin color of the measuring site and pulse waveform. Change the measuring site every 8 hours for disposable probes and every 4 hours for reusable probes. The skin temperature may increase at the attached site by 2 or 3°C (4 or 5°F) and cause a burn or pressure necrosis. When using the probe on the following patients, take extreme care and change the measurement site more frequently according to symptoms and degree.**
  - **A patient with a fever**
  - **A patient with peripheral circulation insufficiency**
  - **Neonate or low birth weight infant with delicate skin**
- **When using the TL-201T finger probe, do not fasten the probe and cable to the finger by wrapping with tape. This may cause burn, congestion or pressure necrosis from poor blood circulation.**
- **When using probes other than the TL-201T finger probe, to avoid poor circulation, do not wrap the tape too tight. Check the blood circulation condition by observing the skin color and congestion at the skin peripheral to the probe attachment site. Even for short-term monitoring, there may be burn or pressure necrosis from poor blood circulation, especially on neonates or low birth weight infants whose skin is delicate. Accurate measurement cannot be performed on a site with poor peripheral circulation.**
- **When not monitoring SpO$_2$, disconnect the SpO$_2$ connection cord from the bedside monitor. Otherwise, noise may interfere from the probe sensor and displays incorrect data on the screen.**
- **Do not use the probe during MRI examination because it may cause skinburn on the probe attachment area. For details, follow the MRI operator’s manual.**

CAUTION

- **When using Nellcor probes, read the instructions provided with the probe.**
- **When using Nellcor probes, do not touch the SpO$_2$ socket pins on the monitor with your finger when connecting or disconnecting the connection cord from the monitor. The monitor may malfunction or get damaged.**
- **Turn off the power of cell telephones, small wireless devices and other devices which produce strong electromagnetic interference. Otherwise, the waveforms and measurements are affected by such interference and the displayed data may be incorrect.**
- **Only use the specified probes. Otherwise SpO$_2$ cannot be monitored properly.**

- **Do not use a damaged or disassembled probe. It causes incorrect measurement and may hurt the patient.**
- **Do not use the probe over its stated lifetime. Otherwise the SpO_2 measurement accuracy cannot be guaranteed.**
- **If the skin gets irritated or redness appears on the skin from the probe, change the attachment site or stop using the probe.**
- **Do not attach the probe to the same limb that is used for NIBP measurement or an IBP catheter.**
- **Normally external light does not affect monitoring, however, strong light such as an operating lamp or sunlight may affect monitoring. If affected, cover the measuring site with a blanket.**
- **When attached, make sure that the light emitter and the photo detector of the probe face each other. Otherwise, SpO_2 cannot be measured properly.**
- **Do not reuse the disposable probes for another patient because it causes cross infection.**
- **Disposable probes are not sterilized. To sterilize the probe, refer to the probe's manual.**
- **When the probe is attached on an appropriate site with sufficient circulation and the error message confirming the probe attachment repeatedly appears, the probe may be deteriorated. Replace it with a new one.**
- **When the probe or SpO_2 connection cord failure message appears on the screen, replace it with a new one. Otherwise SpO_2 data may not be accurate.**
- **If the attachment site is dirty with blood, clean the attachment site before attaching the probe. If there is nail polish on the attachment site, remove the polish. Otherwise, the amount of transmitted light decreases, and measured value may be incorrect or measurement cannot be performed.**
- **To minimize body movement for stable SpO_2 monitoring, fasten the cable with the provided adhesive tape.**
- **Do not pull or bend the probe cable, and do not put caster feet on the probe cable. Do not immerse the probe cable in detergents or water. Failure to follow these cautions may cause cable discontinuity, short circuit, skin burn on the patient and incorrect measurement data. Replace any broken probe with a new one.**
- **Be careful when removing the probe or foam tape from neonatal skin.**
- **When removing a probe that is taped to the skin, do not pull the cable part of the probe because this can damage the probe's cable connection.**
- **Do not immerse the probe in detergents or water. If the probe adhesive surface gets wet, adhesiveness becomes weak and the probe cannot be attached to the skin.**
- **While a patient is on medication which causes vasodilation, the pulse waveform may change and in rare cases the SpO_2 value may not be displayed.**
- **Refer to the probe instruction manual for details.**

NIBP Monitoring

WARNING

- **Be careful when measuring NIBP on a patient with known bleeding disorders or congestion. After NIBP measurement, there may be dot hemorrhage, or circulatory disorder by thrombus where cuff is attached.**
- **When attaching the cuff to a premature infant at an early stage after birth, periodically change the cuff position to avoid possible skin erosion and fissure.**
- **While performing STAT (continuous) measurements many times without a pause, periodically check the blood vessels and limb for adequate circulation.**
- **When performing long term measurements at intervals less than 2.5 minutes, periodically check the state of the patient, blood vessels and limb for adequate circulation.**

CAUTION

- **Only use the specified cuff. Otherwise NIBP monitoring cannot be performed properly or the monitor may be damaged.**
- **Select the cuff which fits each patient. If the cuff size is not correct, measurement may not be completed or the result may be erroneous due to the different deflation speed of the cuff.**
- **The YP-950T/951T/952T/953T/954T/955T reusable cuffs contain natural rubber latex which may cause allergic reactions.**
- **Do not reuse the disposable cuff.**
- **Disposable cuffs are not sterilized. If necessary, sterilize the cuff using glutaraldehyde solution.**
- **The non-sterilized disposable cuffs for neonates cannot be sterilized. If necessary, use the sterilized disposable cuffs for neonates.**
- **Never sterilize the disposable cuff for neonates.**
- **Do not wrap the cuff on an arm or thigh which is used for injection. NIBP measurement on an arm or thigh which is used for injection may cause reflux of blood and stop injection.**
- **Confirm that the air hoses are firmly connected between the sockets and hoses of the cuff. If not connected properly (the air hose connector clicks when properly inserted into the socket), the cuff cannot be correctly identified and air leakage will cause incorrect NIBP data or no data.**
- **When too much pressure is applied to the cuff, or the hose is folded or kinked, the “NIBP SAFETY CIRCUIT RUNNING” message appears on the screen and NIBP monitoring may be stopped. Remove the cause, wait for 40 seconds, check that the message disappears, then measure again.**
- **If the hose is folded or squeezed, it will cause incorrect NIBP data due to the air pressure noise.**
- **Do not rely only on the PWTT* to monitor blood pressure changes. When it is necessary to monitor critical blood pressure change, set the appropriate interval for NIBP measurement.**

- **When the delta PWTT* threshold is too short for a patient, NIBP measurement may be performed too frequently. If this occurs, change the delta PWTT* threshold to a longer time.**
- **The PWTT* may be incorrect when there is too much arrhythmia or noise.**
- **In the following cases, PWTT* may trigger too many or no NIBP measurements. Check the patient condition. If necessary, change the delta PWTT* threshold or set the PWTT* to Off.**
  - **Rapid blood pressure change with vasoreflex due to vasoactive drugs, such as phenylephrine and nicardipine.**
  - **Unstable pulse wave due to poor peripheral circulation.**
  - **Too many arrhythmias.**
  - **Patient movement.**
  - **Noise on ECG due to ESU.**
  - **SpO_2 measurement on foot of a child.**
- **Do not measure NIBP with PWTT* on a neonate because circulation of a neonate changes rapidly.**

* PWTT is only available on the BSM-2301/2351 monitor.

IBP Monitoring

WARNING

- **All parts, except for transducers, must be non conductive. Otherwise, the discharged energy may cause electrical shock to the operator during defibrillation.**
- **Do not use an expired saline pack.**
- **Do not use a blood pressure monitoring kit from a torn package.**
- **Vent out any air inside the saline pack by squeezing the saline pack. Otherwise, the air will cause an error in the blood pressure data and can enter the patient's blood vessel.**

CAUTION

- **Turn off the power of cell telephones and small wireless devices, or other devices which produce strong electromagnetic interference. Otherwise, the waveforms and measurements are affected by such interference and the displayed data may be incorrect.**
- **Check that there are no scratches on the catheter balloon before use.**
- **Do not reuse disposable parts and accessories.**
- **Do not leave bubbles in the flushed dome and extension tube because they will distort the blood pressure waveform.**
- **Carefully flush the tube joints because bubbles tend to remain in the joints.**
- **Do not pressurize the pressure bag until bubbles are removed from both the dome and the extension tubes.**

Temperature Monitoring

CAUTION

- **Select the appropriate probe for the patient. Using adult probes on premature infants and children may injure the mucous membrane.**
- **Do not reuse disposable probes on other patients.**
- **The insulation pad may irritate the skin. In long term monitoring, change the attachment site.**

CO_2 Monitoring

WARNING

Before MRI examination, remove the CO_2 sensor kit from the patient. Failure to follow this warning may cause serious electrical burn on the patient due to local heating caused by dielectric electromotive force. For details, refer to the MRI operator's manual.

CAUTION

- **The CO_2 data may not be accurate when monitoring a patient with an extremely high respiration rate or irregular respiration.**
- **When monitoring CO_2 of a patient under anesthesia, make sure that the gas composition is entered. Otherwise the measurement result may be inaccurate.**
- **When using an anesthetic instrument with a volatile anesthetic agent, the CO_2 measurement may be inaccurate.**
- **Obey the CAUTION label on the CO_2 gas cylinder.**
- **After the lifetime of the CO_2 gas cylinder expires, the measurement accuracy cannot be guaranteed.**
- **When the "CHANGE ADAPTER" or "CHANGE SENSOR" message is displayed, check the CO_2 sensor kit and replace with a new one when necessary. CO_2 cannot be monitored while the message is displayed.**
- **Turn off the power of cell telephones, small wireless devices and other devices which produce strong electromagnetic interference. Otherwise, the waveforms and measurements are affected by such interference and the displayed data may be incorrect.**
- **The measurement may be inaccurate when electromagnetic noise from another instrument interferes with the CO_2 waveform.**
- **We recommend using another method or using a shielded room for monitoring CO_2 when respiration monitoring is important.**

When Using the TG-900P CO_2 Sensor Kit

WARNING

- **With the TG-900P CO_2 sensor kit, measurements are based on the assumption of no CO_2 gas in the inspiration. The CO_2 concentration**

in the respiration is calculated by taking the CO_2 concentration in the inspiration as 0 mmHg. Therefore, measuring CO_2 by connecting the CO_2 sensor kit to a Jackson Rees circuit, Mapleson D circuit or any other respiration circuit where CO_2 gas may be present during inspiration may result in the acquired data being lower than the actual value.

- **When using the YG-101T airway adapter on children or patients with low ventilatory amount, the CO_2 may mix in the inspiration due to the airway adapter's dead space volume (5 mL), resulting in inaccurate measured values or difficulty in detecting apnea. Perform ventilation taking into consideration the 5 mL dead space volume. Do not use the airway adapter on neonates.**

CAUTION

- **With the TG-900P CO_2 sensor kit, secure the CO_2 sensor to the respiration circuit so that its cable is parallel to the floor. If the cable is perpendicular to the floor, water droplets may get onto the transparent film of the airway adapter and affect the measurement accuracy.**
- **With the TG-900P CO_2 sensor kit, this monitor cannot monitor CO_2 of patients younger than 3 years old or weighing less than 10 kg (22 lbs).**
- **Never autoclave or perform EOG gas sterilization for the TG-900P/950P CO_2 sensor kit. It damages the CO_2 sensor kit and safety cannot be guaranteed.**

When Using the TG-950P CO_2 Sensor Kit

WARNING

- **When using the YG-201T airway adapter on children or patients with low ventilatory amount, the CO_2 may mix in the inspiration due to the airway adapter's dead space volume (5 mL), resulting in inaccurate measured values or difficulty in detecting apnea. Perform ventilation taking into consideration the 5 mL dead space volume. Do not use the airway adapter on neonates.**
- **When using the YG-202T airway adapter on children or patients with low ventilatory amount, perform ventilation taking the airway adapter's dead space volume (2 mL) into consideration.**
- **Select the airway adapter taking the patient weight and ventilation volume into consideration. If an inappropriate airway adapter is used, the resistance in the respiration circuit increases or the measurement value is incorrect.**

CAUTION

- **With the TG-950P CO_2 sensor kit, secure the CO_2 sensor to the respiration circuit so that the transparent film of the airway adapter is**

perpendicular to the floor. If the transparent film is parallel to the floor, water droplets may get onto the transparent film and affect the measurement accuracy.

- **With the TG-950P CO_2 sensor kit, measured value may be incorrect when the operating temperature changes greatly. In this case, wait for about 30 minutes to acquire stable measurement.**
- **Never autoclave or perform EOG gas sterilization for the TG-900P/950P CO_2 sensor kit. It damages the CO_2 sensor kit and safety cannot be guaranteed.**

When Using the TG-920P CO_2 Sensor Kit

WARNING

When using the YG-120T/121T/122T nasal adapter on children or patients with low ventilatory amount, the CO_2 may mix in the inspiration due to the nasal adapter's dead space volume (1.2 mL), resulting in inaccurate measured values or difficulty in detecting apnea. Perform ventilation taking into consideration the 1.2 mL dead space volume.

CAUTION

- **With the TG-920P CO_2 sensor kit, measurements are based on the assumption of no CO_2 gas in the inspiration. The CO_2 concentration in the respiration is calculated by taking the CO_2 concentration in the inspiration as 0 mmHg. Therefore, measuring CO_2 of a patient with an oxygen mask where CO_2 gas may be present in the inspiration gas may result in the acquired data being lower than the actual value.**
- **With the TG-920P CO_2 sensor kit, this monitor cannot monitor CO_2 of patients younger than 3 years old or weighing less than 10 kg (22 lbs).**
- **Never autoclave the TG-920P CO_2 sensor kit. It damages the CO_2 sensor kit and safety cannot be guaranteed.**

When Using Airway Adapters/Nasal Adapters

CAUTION

- **The airway adapter/nasal adapter is non-sterilized and disposable. Use only for single patient and single use. Failure to follow this instruction causes cross infection.**
- **Failure to follow the following instructions degrades the anti-fogging ability of the transparent film and results in incorrect measurements.**
  - **Replace the airway adapter/nasal adapter with a new one every 24 hours.**
  - **Replace the airway adapter/nasal adapter with a new one if blood, sputum or mucus adhere to the transparent film.**
  - **Do not damage the transparent film. Do not let dust or detergent**

contact the transparent film. Do not touch, wipe or clean the transparent film with fingers or any cleaners.

- **Do not sterilize the airway adapter and nasal adapter more than once. Safety cannot be guaranteed. They can be sterilized only once and before use.**
- **Use the Nihon Kohden specified airway adapter/nasal adapter.**
- **Stop using the oxygen cannula with the CO_2 sensor kit when arterial oxygen saturation does not increase.**
- **When using the YG-121T/YG-122T nasal adapter on a patient with bleeding disorder, poor general medical condition or malnutrition, observe the patient condition all the time. The mouth guide touches the mouth and may cause pressure sores.**
- **Be careful not to injure the patient's nostrils with the nasal tube.**

Maintenance

CAUTION

- **Do not disassemble the monitor. Disassembly must be performed by a qualified service personnel.**
- **Fuses must be replaced by a qualified service personnel.**
- **Do not use volatile liquids such as thinner or benzine, because these will cause the materials to melt or crack.**
- **Before cleaning the monitor, turn the monitor power off and disconnect the power cord from the AC SOURCE power cord socket on the right side panel.**
- **After cleaning, make sure that the monitor is completely dried.**
- **Wipe the monitor thoroughly after disinfecting it with spray.**
- **The bedside monitor is not waterproof. Be careful not to let any water get inside the monitor.**
- **Never sterilize the monitor because the materials may deform, crack or discolor.**

Section 2 Preparations

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Preparation Flowchart

You may not need to do all these.

1. Install the monitor and do the procedures in Section 2. When you turn on the monitor, check that the correct monitor’s model number appears on the screen with the “CHECK PROGRAM RUNNING” message.

2. Check or change any initial settings on the SYSTEM SETUP screen. These items usually do not need to be changed. Refer to Section 3.

3. Check or change the necessary settings before monitoring in Section 4.
   - Date and time
   - Sound volume
   - Screen brightness
   - Assign function to the function keys
   - Monitoring screen layout

4. Enter the name of the new patient. Refer to “Entering Patient Name” in Section 4.

5. Check or change all alarm items for the patient. Alarm settings return to the default settings 30 minutes after the monitor is turned off. Refer to Section 6.

6. Check or change settings for the vital signs list, trendgraphs and arrhythmia recall files. Refer to Section 7.

7. Check or change recording settings. Refer to Section 8.

8. Prepare the equipment (electrodes, transducers, probes, etc.) for monitoring individual parameters and check or change the settings for each parameter. Refer to Sections 10 to 16.

WARNING

When admitting a new patient, check the alarm settings. The alarm settings return to the alarm master settings on the SYSTEM SETUP screen when all data is deleted on the DELETE ALL window or 30 minutes elapse after monitor power off.

Installation Conditions

Put the monitor on a stable and flat stand or on an optional KC-013P cart in a suitable location where the screen is easy to see and does not reflect light. Follow the cautions below.

For installing the monitor on the KC-013P cart, refer to the KC-013P cart installation guide.

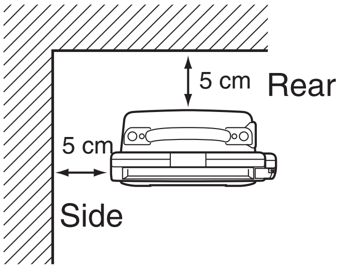
WARNING

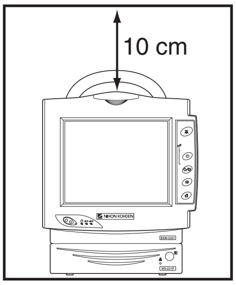
- **Never use this monitor in the presence of any flammable anesthetic gas, concentrated oxygen or hyperbaric oxygen. Failure to follow this warning may result in explosion.**
- **Connect only the specified instruments to the connector or sockets marked with ⚠ by following the specified procedure. Otherwise, electrical leakage current may harm the patient and operator.**

CAUTION

- **Avoid collision when moving the monitor on a cart. Strong impact may damage the monitor.**
- **The display screen is made of glass. Strong impact may damage it.**
- **Avoid a location where the monitor is sprinkled with liquids. Avoid direct sprinkling, spray or moist air from a nebulizer or a humidifier.**
- **If fluids are accidentally spilled on the monitor, take the monitor out of service and check for damage.**
- **Avoid locations where the monitor may receive strong electromagnetic interference such as radio or TV stations, cell phones or mobile two-way radios.**
- **Do not use the monitor in an ambulance. The monitor may not function properly in a moving vehicle.**
- **Avoid exposing the monitor to direct sunlight.**
- **Do not place the monitor in a dusty area.**
- **Do not place blankets or cloth over the monitor. It may affect monitoring.**
- **Connect the power cord to an AC outlet which can supply enough AC current to the monitor. The monitor cannot function properly with low current.**
- **Do not place the monitor in an MRI examination room. The monitor may not function properly, or noise from the monitor may interfere with the MRI.**
- **Do not use an electrical blanket. It may affect monitoring.**

- **Make sure that there is more than 5 cm of space between the monitor and the wall for adequate ventilation. When the monitor is surrounded, make sure that there is about 10 cm of space above the monitor for ventilation so that the operating temperature does not exceed 40°C (104°F).**





  Avoid placing the monitor near a heater or humidifier.

- **When there is any problem on the monitor, turn off the power immediately and disconnect the power cord from the AC outlet. Take the monitor out of service and check for damage.**

Preparing the Optional Recorder Module

Installing the Recorder Module

Install the optional WS-231P recorder module to the monitor by referring to the WS-231P recorder module installation guide.

Loading the Recording Paper

CAUTION for Handling the Recording Paper

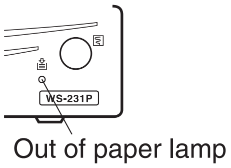
- **Do not allow paper to contact pastes, adhesive agents, oil-based felt pen tips or diazo process (ditto/spirit) copying paper. These discolor the paper surface.**
- **Do not allow paper to contact any materials made of vinyl chloride, plastic eraser, adhesive tape, fluorescent felt tip pen, or cinnabar seal ink because these discolor the recorded waveforms and data.**
- **Do not apply strong pressure to the paper. Rubbing or scratching discolors the paper surface.**
- **Do not allow paper to contact saline solution. The paper discolors and if the saline solution gets on the thermal head, there will be dots missing from the recorded data.**
- **Avoid high humidity, high temperature, direct sunlight and direct fluorescent light when storing recording paper. Otherwise the paper may discolor. Store the recording paper in a dry, cool place.**
- **When using glue on the recording paper, use glue which consists of starch, polyvinyl alcohol, gum arabic, or carboxymethyl.**

CAUTION for Loading the Recording Paper

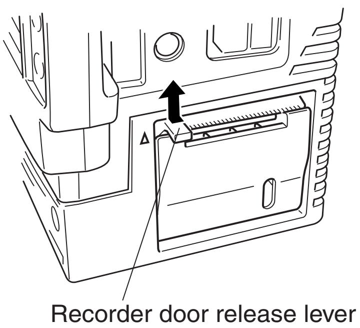
- **Correctly load the recording paper as specified. Otherwise, recording may not be performed properly.**
- **Do not touch the recording head with any hard material. When the head is tapped with hard material, the head may crack and the heater element wire may short-circuit.**
- **Clean the head surface with the provided head cleaner pen before loading new paper. After a period of usage, paper dust may accumulate between the paper and the head surface, and good printing cannot be obtained.**

NOTE

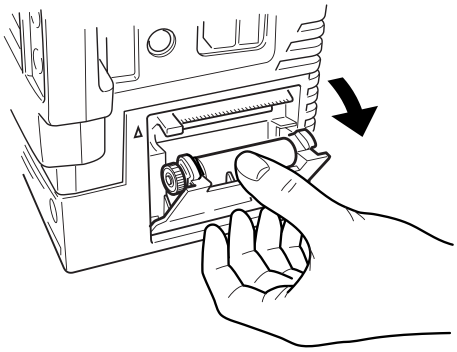
Only use the specified recording paper, FQW50-3-100.


WS-231P
Out of paper lamp

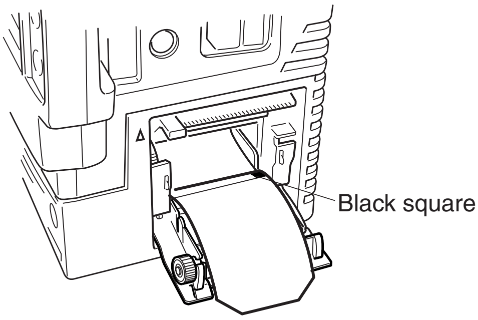
The out of paper lamp on the recorder module lights and the ▤ out of paper mark appears on the screen when there is no paper.


Recorder door release lever

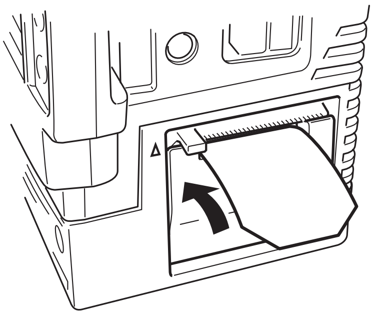
1. Move the recorder door release lever in the direction of the arrow (△) to release the lock.



2. Open the recorder door.


Black square

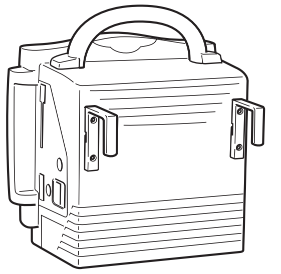
3. Set the recording paper (FQW50-3-100) inside the recorder so that the detection mark (small black square on corner) of the paper is on the right side.

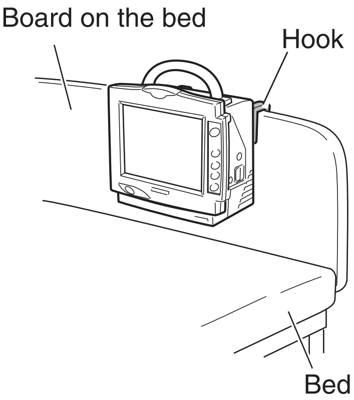


4. Draw out one page of paper toward you and close the recorder door.

   If the out of paper lamp is still lit, the recorder door is not closed properly.

Attaching the Optional Hooks



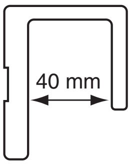


The optional DZ-230P hooks can be attached to the monitor so that the monitor can be hooked onto a board of a bed. The board thickness must be less than 40 mm.

Attach the hooks to the monitor by referring to the DZ-230P hooks installation guide.

CAUTION

- **Use these hooks only for hooking the BSM-2300 series bedside monitors onto a board.**
- **Do not carry the monitor by the hooks.**
- **Hook the monitor onto a board which can support the weight of the monitor.**
- **To prevent the monitor from falling off, periodically check that the hooks are attached to the monitor properly.**
- **Do not put weight on the hooks and monitor.**
- **Make sure that both hooks are properly hooked onto the board.**
- **When moving a bed with a monitor hooked to it, make sure that the monitor does not fall off.**
- **Hook the monitor only onto a board that is less than 40 mm thick.**

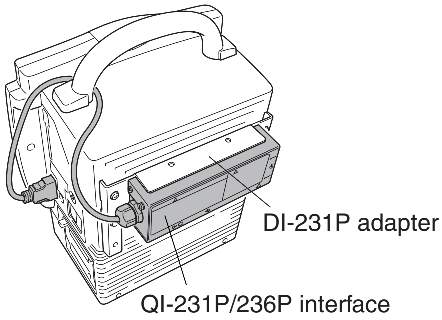


Hook size

NOTE

When using the optional transmitter, attach the transmitter to the monitor before attaching the hooks.

Connecting an External Instrument to the Monitor



An external instrument, such as a display monitor, can be connected to the AUX socket on the right side panel. For details, contact your Nihon Kohden distributor.

With an optional QI-231P/236P interface, the ECG analog signal, QRS sync signal or *trigger signal at alarm occurrence can be output from the monitor. A display monitor can also be connected to the interface. (* QI-231P only)

The QI-231P/236P interface can be mounted on the KC-013P cart. To mount the interface onto the monitor, an optional DI-231P adapter is required. To connect the interface to the monitor, refer to the QI-231P/236P interface operator's manual.

With an optional QI-235P interface, Oridion Microcap® capnograph monitor can be connected to the monitor and the data acquired by the Microcap® can be displayed on the monitor screen.

WARNING

For patient safety, equipotential grounding of all instruments must be performed. Consult with a qualified biomedical engineer.

When more than one electrical instrument is used, there may be electrical potential difference between the instruments. Potential difference between instruments may cause current to flow to the patient connected to the instruments, resulting in electrical shock (micro shock). Never use any medical equipment in patient treatment without proper grounding.

Always perform equipotential grounding as specified in IEC 60601-1-1 when required. It is often required in the operating room, ICU room, CCU room, cardiac catheterization room and X-ray room. Consult with a biomedical engineer to determine if it is required. Refer to the reference "General Requirements for Connecting Medical Electrical System" in Section 19.

WARNING

Connect only the specified instruments to the connector or sockets marked with ⚠ by following the specified procedure. Otherwise, electrical leakage current may harm the patient and operator.

CAUTION

Disconnect the power cord from the AC SOURCE socket before connecting the instruments.

Connecting the Monitor to a Network

Either a QI-101P network card or a QI-111P network printer card can be inserted into the bedside monitor. These two cards cannot be used at the same time.

The optional QI-101P network card allows connection to a monitor network*. Bedside monitor data can be sent to the central monitor or any other bedside monitor in the network.

The optional QI-111P network printer card allows connection to a bedside monitor network with no central monitor*. Monitor data can be printed on a printer connected to the network. The review window data and manual printing can be performed.

* For details about the central monitor network and bedside monitor network, refer to the Network and System Installation Guide.

With an optional QI-210P wireless LAN station and QI-902R wireless LAN access point, the bedside monitor data can be radio communicated to the monitor network. The wireless LAN station is mounted on the bedside monitor and the cable of the wireless LAN station is connected to the QI-101P network card installed on the bedside monitor. The wireless LAN access point is installed in your facility and connected to the monitor network. The monitor data is communicated between the wireless LAN station and wireless LAN access point and is sent from the wireless LAN access point to the central monitor or any other monitor in the network. For details, contact your Nihon Kohden distributor.

WARNING

For patient safety, equipotential grounding of all instruments must be performed. Consult with a qualified biomedical engineer.

When more than one electrical instrument is used, there may be electrical potential difference between the instruments. Potential difference between instruments may cause current to flow to the patient connected to the instruments, resulting in electrical shock (micro shock). Never use any medical equipment in patient treatment without proper grounding.

Always perform equipotential grounding as specified in IEC 60601-1-1 when required. It is often required in the operating room, ICU room, CCU room, cardiac catheterization room and X-ray room. Consult with a biomedical engineer to determine if it is required.

Refer to the reference “General Requirements for Connecting Medical Electrical System” in Section 19.

WARNING

Connect only the specified instruments to the connector or sockets marked with ⚠ by following the specified procedure. Otherwise, electrical leakage current may harm the patient and operator.

CAUTION

The network must be managed by the network administrator. Make sure that each monitor in the network has a different IP address. Otherwise, data communication cannot be performed properly. When adding a unit to an already operating network, set the IP address on the monitor before connecting the monitor to the network.

Inserting the Network Card or Network Printer Card

The network card or network printer card can be inserted while the monitor power is on.

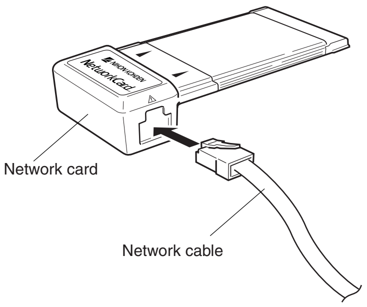
For details on handling the network card and network printer card, refer to the QI-101P network card or QI-111P network printer card operator's manual.

WARNING

- **Connect the network as specified. Otherwise patient and operator may get electrical shock or other injury. For connecting the network, contact your Nihon Kohden distributor.**
- **Do not use the damaged network cable. Otherwise patient or operator may get an electrical shock when the damaged part is touched.**

NOTE

- **Use only the shielded network cable with the resin plug for the HUB connector.**
- **Use only a hub which complies with IEC 950 or UL 1950.**
- **When the network card or network printer card is inserted into the monitor, the optional transmitter cannot be used.**



1. Connect the network cable to the socket on the network card or network printer card. Insert the cable connector until it clicks.

CAUTION

Do not push in the network cable with too much force. Otherwise the network card, network printer card or bedside monitor may get damaged.

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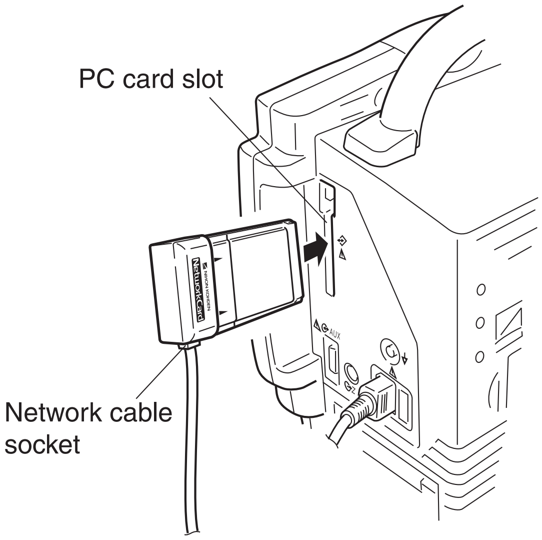
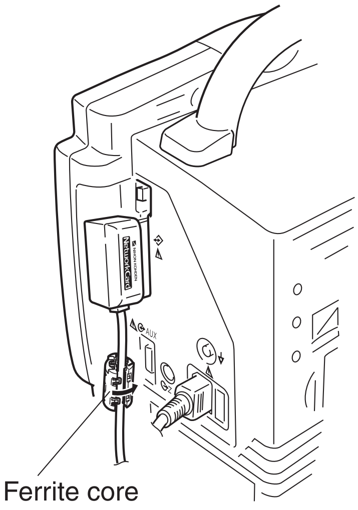
2. Insert the network card or network printer card into the PC card slot on the right side panel with the cable side facing down.



3. Attach the ferrite core to the network cable.



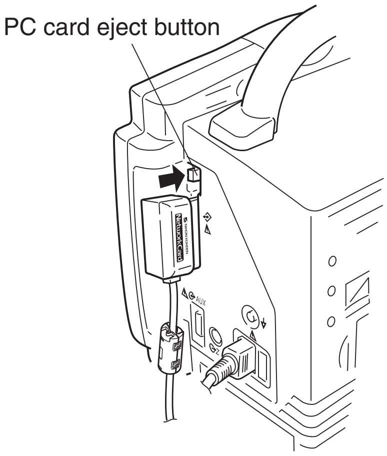
NOTE

A ferrite core must be attached to every network cable.

4. When the network card/network printer card is installed, the data is communicated between the monitors in the network. The 🔄 icon appears when using network card or the 🖨 icon appears when using network printer card at the upper right corner of the screen during communication.

Removing the Network Card or Network Printer Card

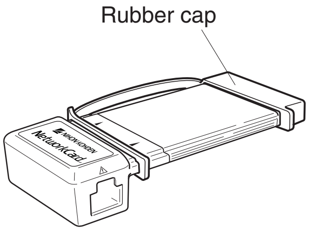
1. Press the PC card eject button and remove the network card/network printer card from the monitor.



NOTE

The network card/network printer card may get hot after long term use, but this does not mean that the card is damaged.

2. Remove the network cable from the network card/network printer card.



3. Check that there is no scratches, dirt or damage to the network card/network printer card, attach the rubber cap to the PCMCIA connector as shown below and store the card in an appropriate place.

Using the QI-210P Wireless LAN station

With an optional QI-210P wireless LAN station and QI-902R wireless LAN access point, the bedside monitor data can be radio communicated to the monitor network. The wireless LAN station is mounted on the bedside monitor and the cable of the wireless LAN station is connected to the QI-101P network card installed on the bedside monitor. The wireless LAN access point is installed in your facility and connected to the monitor network. The monitor data is communicated between the wireless LAN station and wireless LAN access point and is sent from the wireless LAN access point to the central monitor or any other monitor in the network. For details, contact your Nihon Kohden distributor.

Power

AC or Battery Power Source Selection

The monitor can operate on either battery or AC power.

When the power cord is plugged into an AC outlet and the power switch on the front panel is turned on, the monitor operates on AC power.

When a battery is installed and the power cord is disconnected, such as when transferring a patient, the monitor automatically switches to battery power.

The battery is charged when the power cord is plugged into an AC outlet and the AC current is supplied to the monitor. The battery is also charged during monitoring.

When the monitor is operated on battery power, the brightness of the screen can be reduced to save battery power. Refer to Section 3.

The monitor can operate for about 3 hours with a fully charged battery pack when:
- Charged and used in normal temperature (about 25°C)
- Recorder is not used
- No alarm occurs
- No NIBP measurement
- POWER SAVING MODE on the SYSTEM SETUP screen is set to ON.

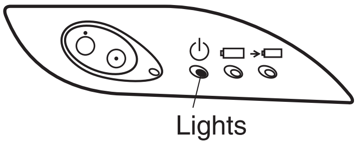
Connecting the Power Cord and Grounding the Monitor

Connecting the Power Cord

WARNING

- **Only use the provided power cord. Using other power cords may result in electrical shock or other injury to the patient and operator.**
- **When the provided power cord cannot be used, operate the monitor on battery power.**

Connect the provided power cord to the AC SOURCE socket on the side panel of the monitor and plug the cord into a 3-prong AC outlet.



When the AC power is supplied to the monitor, the AC power lamp on the front panel lights and a buzzer sounds.

NOTE

If the AC power lamp does not light or there is no buzzer sound, check the power cord connection.

Grounding the Monitor

WARNING

- **For patient safety, equipotential grounding of all instruments must be performed. Consult with a qualified biomedical engineer.**
- **When equipotential grounding is doubtful (such as in poor grounding facility), operate the monitor on battery power.**

When more than one electrical instrument is used, there may be electrical potential difference between the instruments. The potential difference between the instruments may cause current to flow to the patient connected to the instruments, resulting in electrical shock (micro shock).

Always perform equipotential grounding when required. It is often required in the operating room, ICU room, CCU room, cardiac catheterization room and X-ray room. Consult with a biomedical engineer to determine if it is required.

When equipotential grounding is required, connect the equipotential ground terminal on the instrument to the equipotential ground terminal on the wall (equipotential grounding system) with the equipotential grounding lead (potential equalization conductor).

Turning the Monitor On

Check Before Turning On the Monitor

Check the following items before turning on the monitor.

- Enough electrodes and electrode leads are ready.
- Cleaned and sterilized sensors and transducers are ready.
- Power cord is connected properly.
- Equipotential grounding lead is connected properly when equipotential grounding is required.
- All cables are connected properly.
- Batteries are fully charged when operating on battery power.
- No scratches, damage or dirt on the monitor.
- No damage to the keys, switch and panels.
- No damage to the power cord.
- No damage to the electrode leads, transducers, probes and cables.
- The monitor is not in a wet place.
- The handle and hooks (option) are not damaged.
- Enough recording paper in the recorder (when using an optional recorder module).

Turning the Monitor On

CAUTION

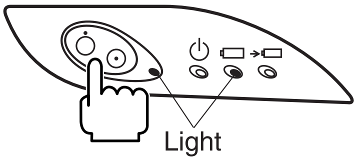
Do not turn the monitor off when the system check screen is displayed. Otherwise the saved data may be damaged or deleted. If the monitor is turned off during system check, delete all data because the data is not reliable.

NOTE

- **It takes a few minutes for the LCD screen to reach full brightness.**
- **The shadow of the previous screen may remain for a few minutes after changing screens.**
- **There may be some dots on the LCD screen which are always on or always off, but it does not affect monitoring. This is normal for all LCD screens.**

CAUTION

At the monitor on, check that one "bong" sounds and the red alarm lamp, yellow alarm lamp and green lamp blink once to show that the alarm functions properly.

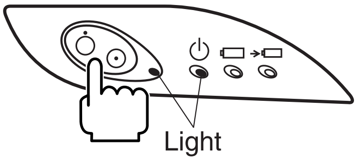


- **When operating on battery power**

  After installing a fully charged battery pack, press the power switch on the front panel to ON. The power and battery power lamps light, a buzzer sounds and the "CHECK PROGRAM RUNNING" message appears on the screen.

  If the power and battery power lamps do not light and there is no buzzer sound, check the battery condition.

  When the power is turned on again within one hour after using the monitor on battery, the buzzer does not sound.



- **When operating on AC power**

  After grounding and connecting the power cord, press the power switch on the front panel to ON. The power lamp and the AC power lamp light and the "CHECK PROGRAM RUNNING" message appears on the screen.

  If the power lamp does not light, check the power cord connection.

Standby Mode

When the monitor power is turned on, it enters “standby mode” while the monitor is waiting for the electrodes and probe to be attached to the patient. “CHECK ELECTRODES”, “CHECK PROBE”, “CANNOT DETECT PULSE” and “CHECK SENSOR” alarms will not be activated. “DETECTING PULSE” message will not be displayed. The monitor changes from standby mode to normal monitoring when the ECG or SpO_2 monitoring starts. The monitoring starts when the connection cord is connected to the socket on the monitor and electrodes or probe is attached to the patient.

If the monitor power is turned off and on again within 10 seconds, the monitor skips standby mode.

Check After Turning On the Monitor and During Monitoring

To start monitoring safely and properly, check the following items after turning on the monitor. If any problem is detected, take the proper countermeasure according to the troubleshooting and maintenance sections.

- There is no fire, smoke or smell.
- The monitor is not too hot.
- The power lamp lights.
- Alarm indicators blink once and a bong sounds.
- The start up screen appears and the monitoring screen appears.
- No error message is displayed on the screen.
- The time on the screen is correct.
- The low battery mark does not appear on the screen when operating on battery.
- The monitor does not affect surrounding equipment.
- The data and waveforms are displayed properly.
- Keys and switch operate properly.
- The touch keys function properly.
- Alarm functions properly.
- There is no trouble in recording (when using an optional recorder module).
- Calibration is performed properly. Refer to “Calibrating Waveforms”in Section 18.

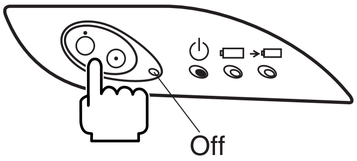
NOTE

After turning the monitor on and when admitting a patient on the monitor, make sure that the time displayed at the upper right of the screen is correct. When the date or time is changed during monitoring, the date and time of all stored data is also changed and may not match the date and time on the printout.

When the monitor is connected to a network

The time on this monitor is automatically adjusted to match the time of the network as long as the monitor is connected to the network. The date and time on all monitors in the network are set to the same setting.

Turning the Monitor Off



1. Press the power switch on the front panel for more than one second to turn the monitor off. The screen becomes dark and the power lamp on the front panel turns off.

Check After/Before Turning the Monitor Off

Check the following items for the next use.

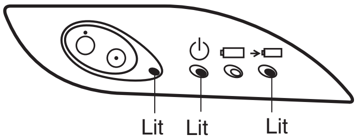
- Previous patient data is deleted.
- Temporarily changed settings are changed back to the previous settings.
- There is no dirt, damage or scratches on the monitor.
- The sensors, probes, transducers, and cables are cleaned and sterilized.
- Accessories are cleaned and stored properly.
- There are enough consumables, such as recording paper, and disposable electrodes for the next use.
- Battery pack is fully charged.
- Battery pack is removed from the monitor when not operating for a long period of time.
- The power switch on the monitor is turned off and the power cord is disconnected from the monitor.
- The monitor is not in a wet place.
- Dead batteries are disposed of properly.
- The medical waste is disposed of properly.
- The monitor is stored properly.

Power and Battery Status Indications

Power and battery status are indicated by four lamps on the front panel. A discharged battery is also indicated by a screen message and alarm.

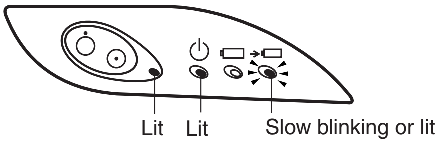
NOTE

When charging the battery with the monitor power switch turned off, check that the power lamp and battery charging lamp light. If the lamps do not light even when the power cord is connected and the battery is inserted, turn the power switch on, check that the battery charging lamp is blinking or lit, then turn the power switch off.



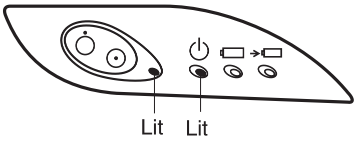
- Operating on AC power and battery is fully charged

Power lamp:	Lit
AC power lamp:	Lit
Battery power lamp:	Off
Battery charging lamp:	Lit



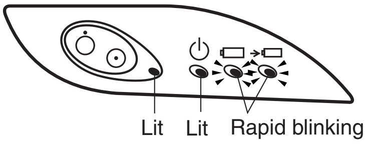
- Operating on AC power and battery is being charged

Power lamp:	Lit
AC power lamp:	Lit
Battery power lamp:	Off
Battery charging lamp:	Slow blinking (once every 2 seconds) or lit



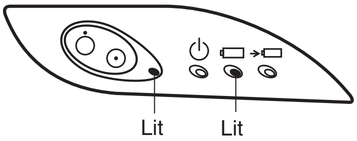
- Operating on AC power with no battery

  Power lamp: Lit
  AC power lamp: Lit
  Battery power lamp: Off
  Battery charging lamp: Off



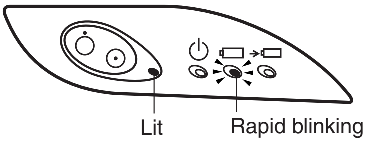
- Operating on AC power and battery is damaged

  Power lamp: Lit
  AC power lamp: Lit
  Battery power lamp: Rapid blinking (4 times per second)
  Battery charging lamp: Rapid blinking (4 times per second)



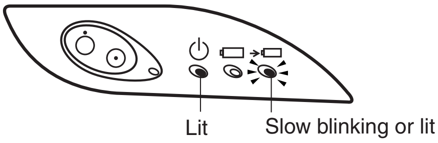
- Operating on battery power

  Power lamp: Lit
  AC power lamp: Off
  Battery power lamp: Lit
  Battery charging lamp: Off



- Operating on battery power and battery needs recharging

  Power lamp: Lit
  AC power lamp: Off
  Battery power lamp: Rapid blinking (4 times per second)
  Battery charging lamp: Off
  Screen indication: “BATTERY WEAK” message
  Alarm indication: Continuous “bing bong” sound and blinking yellow alarm lamp



- No monitoring and charging battery

  Power lamp: Off
  AC power lamp: Lit
  Battery power lamp: Off
  Battery charging lamp: Slow blinking (once every 2 seconds) or lit

Battery Handling and Operation

Safety Information

WARNING

- **Keep the battery pack away from fire. The battery pack may explode.**
- **Do not heat the battery pack. The battery pack may explode.**
- **Never short-circuit the + and – terminals on the battery pack with a wire or store the battery pack with metals such as necklace or hair pins. The battery pack may short-circuit, causing the substance inside the battery to leak or explode.**
- **Never disassemble or modify the battery pack. Never damage or directly solder the sheath tube. The battery pack short-circuits, the electrolyte comes out and the battery pack explodes.**
- **Do not subject the battery pack to a strong mechanical shock. The battery may leak or explode.**

- **Do not use a battery which is damaged, such as from falling. There is a gas discharge valve inside the battery and if this valve is damaged, the gas cannot be discharged, causing the battery to explode.**
- **Only use the battery pack on the specified instrument. If the battery is used on an unspecified instrument, large current may flow, causing the battery to explode.**
- **If the battery pack is damaged and the substance inside the battery (alkaline liquid) contacts the eyes or skin, wash immediately and thoroughly with water and see your physician. Never rub your eyes, otherwise you may lose your eyesight.**
- **The battery pack has + and – polarity. Make sure that the battery is installed with the correct polarity direction. Otherwise, the substance inside the battery may leak and explode.**
- **Do not connect the battery pack to an AC outlet or lighter socket in a car. The battery may explode.**
- **Do not immerse the battery pack in water or seawater. The battery will rust and may heat up.**
- **Never use a battery pack which is damaged, discolored or has leakage. A damaged battery may explode if used.**

CAUTION

- **Do not expose the battery pack to direct sunlight or leave in a high temperature place. The lifetime of the battery pack may be shortened or the substance inside the battery pack may leak.**
- **Do not leave a used battery pack for a long period of time (more than one year). The substance inside the battery may leak.**
- **The battery pack must be replaced by qualified service personnel.**
- **Keep the battery pack away from children.**
- **Before disposing of the battery, check with your local solid waste officials for details in your area for recycling options or proper disposal. The battery is recycleable. At the end of its useful life, under various state and local laws, it may be illegal to dispose of this battery into the municipal waste stream.**

NOTE

- **Fully charge the new battery pack before using on the monitor.**
- **Do not use a battery pack which is past the expiration date written on the label.**
- **Always charge the battery between 10°C (50°F) and 40°C (104°F). Temperatures out of this range affect the working of the battery and may cause the battery pack to leak or explode.**
- **Do not leave a battery pack inside the monitor without the power cord connected between the monitor and AC outlet. The battery pack may be over-discharged and can no longer be used.**

- **When not using the monitor for a long period of time (more than two months), remove the battery pack from the monitor and store the battery at temperatures between –20°C (–4°F) and +30°C (86°F) and low humidity.**
- **Before disposing of the monitor, make sure that the battery pack is removed from the monitor.**

Battery Lifetime

The battery pack lifetime is one year or 200 cycles of discharging/charging. Write the date of first use of the battery on the start date label provided with the battery pack and attach it to the bedside monitor where it is easy to see (upper part of the left side panel recommended). Write the same date on the label of the battery pack.

When the battery operating time becomes less than two hours, replace the battery with a new one.

Use a battery until it is fully discharged (BATTERY WEAK message appears), then fully charge the battery. The battery life will be longer if it is fully discharged before charging it again.

Battery Handling Procedures

- Every time the monitor is used on battery power, charge the battery immediately after use.
- Replace the battery with a new one after 200 cycles of discharging/charging or after one year, whichever comes first. This is because the battery is a chemical product which gradually deteriorates whether or not it is used.

When Using a Battery for the First Time or After Storage

- Fully recharge the battery before using it for the first time or after storing it for over a month. When the battery is not used, it self-discharges.

When Not Using the Monitor or Battery

WARNING

Do not leave the battery for more than two years unused. The battery may leak.

- When not using the monitor for one to two months, fully charge the battery before storing the monitor.
- When not using the monitor for more than two months, remove the battery. When a charged or discharged battery is left inside the monitor with the power cord unplugged, the battery self-discharges and deteriorates.
- Store the battery packs under the following conditions.

  Temperature: –20 to 30°C (–4 to 86°F)
  Humidity: 65% ±20% relative humidity

When the BATTERY WEAK Message Appears

When the “BATTERY WEAK” message appears, connect the power cord to the monitor, operate the monitor on AC power and charge the battery.

If no AC or battery power is supplied to the monitor, there is no measurement or display but no data is lost.

When using a fully charged battery, the battery has approximately 5 to 15 minutes of power left when the “BATTERY WEAK” message is displayed.

Installing or Replacing the Battery

The battery pack must be installed or replaced by qualified service personnel. Refer to the bedside monitor service manual.

Charging the Battery

The battery pack can only be charged by the monitor. It takes about 16 hours to charge a battery pack on the monitor.

The monitor can operate for about 3 hours with a fully charged battery pack when:
- Charged and used in normal temperature (about 25°C)
- Recorder is not used
- No alarm occurs
- No NIBP measurement
- POWER SAVING MODE on the SYSTEM SETUP screen is set to ON.

CAUTION

When charging the battery pack, keep the ambient temperature at approximately 20°C to maintain the optimal battery operation time. If the battery pack is charged at less than 10°C (50°F) or more than 40°C (104°F), the maximum battery operation time will be 20% to 30% less than the optimal operation time.

During AC operation, the battery is automatically charged without interrupting monitoring. It takes approximately 16 hours of continuous charging to fully charge the battery pack. After 16 hours of continuous charging, the monitor automatically switches to trickle charging mode to maintain the battery pack fully charged. Trickle charging is necessary because the battery pack can self-discharge even when it is not in use.

NOTE

- **Do not disconnect the power cord from the monitor during battery charging.**
- **If the 16 hours of continuous normal charging is disrupted for more than one hour by power failure in the main power supply or by**

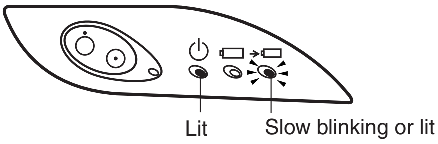
temporary removal of the battery pack from the monitor, the monitor's normal charging circuit is reset, and the battery pack is charged for another 16 hours regardless of how many hours it was charged before the disruption. This deteriorates the battery.

1. Install the battery pack into the monitor.

2. Connect the power cord to the monitor and the AC outlet. The monitor charges the battery pack regardless of whether the monitor power switch is on or off.

   During charging, the battery charging lamp on the front panel blinks.

   After 16 hours, the battery charging lamp is continuously lit and the battery charging is completed.



Disposal of Battery Pack

Before disposing of the battery, check with your local solid waste officials for details in your area for recycling options or proper disposal. The battery is recycleable. At the end of its useful life, under various state and local laws, it may be illegal to dispose of this battery into the municipal waste stream.

Section 3 Changing System Setup Settings

Displaying the SYSTEM SETUP Screen 3.2
    Changing Settings 3.3
    Closing the SYSTEM SETUP Screen and Displaying the Monitoring Screen 3.3
List and Explanation of the SYSTEM SETUP Settings 3.4
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    Display Settings (DISPLAY SETUP) 3.7
    Bed ID Setting (BED ID SETUP) 3.8
    Parameter and Other Settings (PARAMETER SETUP) 3.9
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    Unit Settings (UNITS SETUP) 3.14
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    Other Settings (OTHER SETUP) 3.19
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    Network Settings (NETWORK SETUP) 3.23
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Initializing the System 3.27

This section explains how to change settings after the monitor is installed and before monitoring waveforms.

The initial settings on the SYSTEM SETUP screen must be changed before monitoring. Changing these settings during monitoring interrupts monitoring.

All other settings can be changed any time without interrupting monitoring.

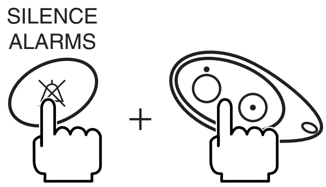
This section also explains how to initialize the system. This procedure returns all settings to the factory default settings and deletes all stored data in memory.

Displaying the SYSTEM SETUP Screen

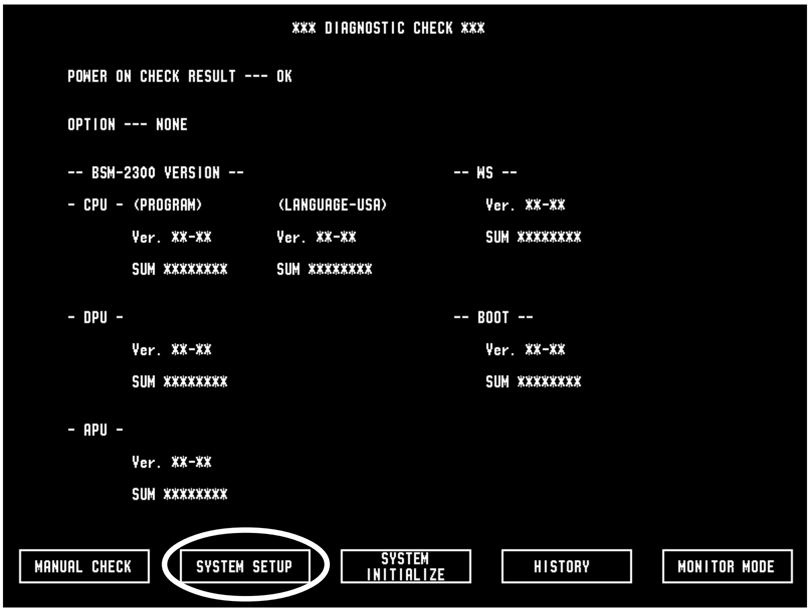
WARNING

This procedure interrupts all monitoring. Only change these settings before or after monitoring.

1. Turn the monitor power off.


SILENCE
ALARMS
+

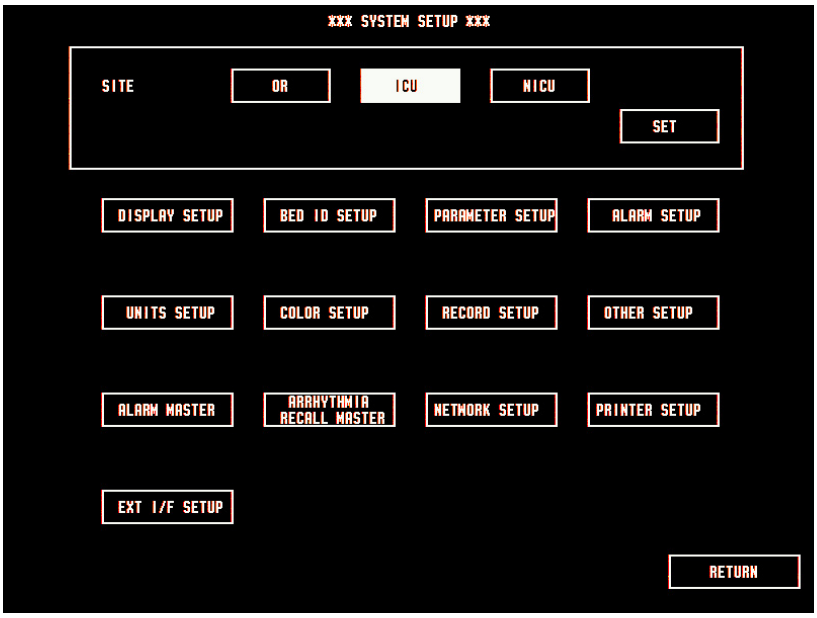
2. Press the power switch while pressing the SILENCE ALARMS key on the front panel until the DIAGNOSTIC CHECK screen is displayed.



```
*** DIAGNOSTIC CHECK ***

POWER ON CHECK RESULT --- OK

OPTION --- NONE

-- BSM-2300 VERSION --                            -- WS --
- CPU - (PROGRAM)         (LANGUAGE-USA)              Ver. XX-XX
        Ver. XX-XX        Ver. XX-XX                  SUM XXXXXXXX
        SUM XXXXXXXX      SUM XXXXXXXX

- DPU -                                           -- BOOT --
        Ver. XX-XX                                    Ver. XX-XX
        SUM XXXXXXXX                                  SUM XXXXXXXX

- APU -
        Ver. XX-XX
        SUM XXXXXXXX
```

MANUAL CHECK
SYSTEM SETUP
SYSTEM INITIALIZE
HISTORY
MONITOR MODE

3. Touch the "SYSTEM SETUP" key. The SYSTEM SETUP screen appears.


*** SYSTEM SETUP ***
SITE
OR
ICU
NICU
SET
DISPLAY SETUP
BED ID SETUP
PARAMETER SETUP
ALARM SETUP
UNITS SETUP
COLOR SETUP
RECORD SETUP
OTHER SETUP
ALARM MASTER
ARRHYTHMIA RECALL MASTER
NETWORK SETUP
PRINTER SETUP
EXT I/F SETUP
RETURN

Changing Settings

1. Touch the desired item on the SYSTEM SETUP screen. A setup screen for that item appears.
2. Touch a setting key on the screen to set the condition.
3. Touch the “RETURN” key to return to the SYSTEM SETUP screen.
4. Repeat steps 1 to 3 to change other setup settings.

Closing the SYSTEM SETUP Screen and Displaying the Monitoring Screen

1. After you change all desired settings, touch the “RETURN” key on the SYSTEM SETUP screen. The new settings are entered and the screen returns to the DIAGNOSTIC CHECK screen.
2. Touch the “MONITOR MODE” key. After a few seconds, the monitoring screen appears.

List and Explanation of the SYSTEM SETUP Settings

List of All Settings

The factory default settings are underlined.

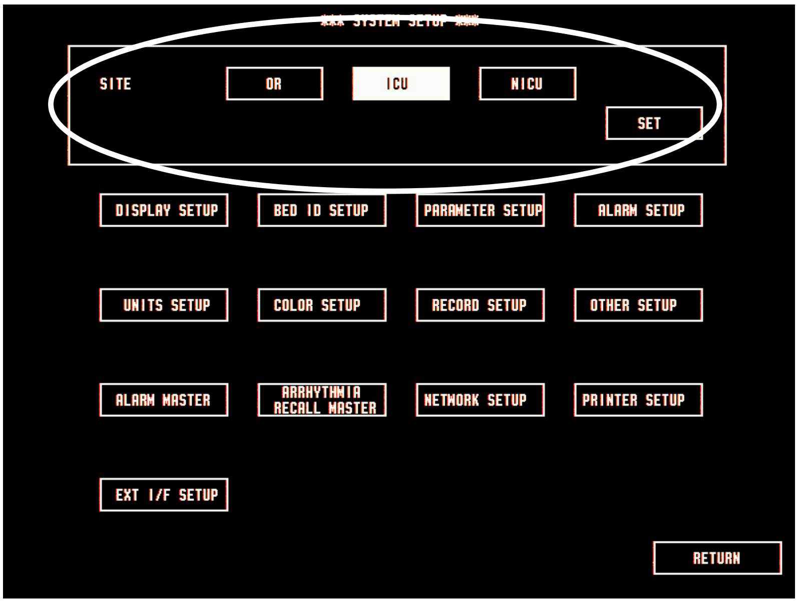
SETUP type	Item		Setting Conditions
SITE			OR, ICU, NICU
DISPLAY SETUP	WAVE DISPLAY		FIXED, MOVING
	SWEEP SPEED		25 mm/s, 50 mm/s
	DISPLAY COLOR MODE		PARAMETER, ALARM
	POWER SAVING MODE		ON, OFF
BED ID SETUP			Up to 8 alphanumeric characters OR: OR-001, ICU: ICU-001, NICU: NICU-01
PARAMETER SETUP	LINE FREQUENCY*		AUTO, 50Hz, 60 Hz
	NIBP MODE AFTER STAT		MANUAL, 2 min, 2.5 min, 5 min, 10 min, 15 min, 30 min
	OLD NIBP DATA AFTER		DIM, HIDE 10 min, 30 min, 1h, 24h OR: 10 min ICU, NICU: 30 min
	NIBP COMPLETION SOUND		ON, OFF OR: ON ICU, NICU: OFF
	NIBP STAT MODE		STAT, 1 min
	NIBP INTERVAL MASTER		MANUAL, STAT, 2 min, 2.5 min, 5 min, 10 min, 15 min, 30 min, 1 h, 2 h, 4 h, 8 h
	ECG ELECTRODE		IEC, AHA
	NOISE REDUCTION ON IMPEDANCE RESP		ON, OFF
	PRESS FILTER		10 Hz, 20 Hz
ALARM SETUP	SILENCE TIME		1 min, 2 min
	ALARM LIMIT DISPLAY		MARK BRIGHT, MARK DIM, VALUES OR, ICU: MARK BRIGHT NICU: VALUES
	EXIT SLEEP MODE ON ALARM		YES, NO
	ALARMS OFF TYPE		SUSPEND MONITORING, BYPASS, ALL ALARMS OFF OR: BYPASS ICU, NICU: SUSPEND MONITORING
	SUSPEND ALARM TIME		0 min, 1 min, 3 min
	SUSPEND MONITORING ON DATA DELETION		YES, NO
	ALARM LEVEL	HR	CRISIS, WARNING, ADVISORY
		SpO2	CRISIS, WARNING, ADVISORY
		PRESS	CRISIS, WARNING, ADVISORY
		NIBP	CRISIS, WARNING, ADVISORY
		APNEA	CRISIS, WARNING, ADVISORY OR, ICU: WARNING NICU: CRISIS
		ECG CHECK ELECTRODES	WARNING, ADVISORY
		SpO2 CHECK PROBE	WARNING, ADVISORY
		ECG NOISE	WARNING, ADVISORY
		VPC RUN	CRISIS, WARNING, ADVISORY
		COUPLET	CRISIS, WARNING, ADVISORY
		EARLY VPC	CRISIS, WARNING, ADVISORY
		BIGEMINY	CRISIS, WARNING, ADVISORY
		FREQ VPC	CRISIS, WARNING, ADVISORY
		TACHYCARDIA	CRISIS, WARNING, ADVISORY
		BRADYCARDIA	CRISIS, WARNING, ADVISORY OR, ICU: WARNING NICU: CRISIS
UNITS SETUP	PRESSURE UNIT		mmHg, kPa
	TEMPERATURE UNIT		CENTIGRADE, FAHRENHEIT
	ST UNIT		mV, mm
	HEIGHT UNIT		cm, inch

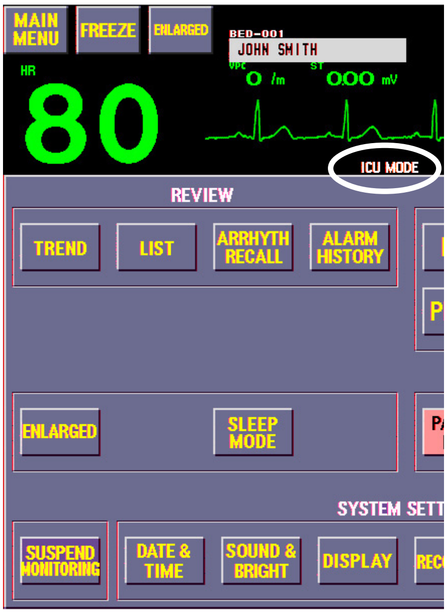
* This setting is not available on the BSM-2304 monitor.

SETUP type	Item		Setting Conditions
COLOR SETUP	PARAMETER COLOR		Green, scarlet, pink, sky blue, violet, pale yellow, pale green, light blue, white (black), orange, yellow, red Default settings ECG: green RESP/CO2: white NIBP: pink SpO2: sky blue ART, ART-2, RAD, DORS, AO, FEM, UA, LVP, PRESS: red UV, CVP, RAP, PRESS-2: light blue PAP, RVP, LAP: yellow ICP, ICP-2: pale yellow TEMP: orange
	PARAMETER (EXTERNAL)		Green, scarlet, pink, sky blue, violet, pale yellow, pale green, light blue, white (black), orange, yellow, red Default settings Fi/EtCO2: white Fi/EtN2O: light blue Fi/EtO2:green Fi/EtHAL: red Fi/EtISO: violet Fi/EtENF: orange Fi/EtDES: sky blue Fi/EtSEV: yellow CNIBP: orange
	ALARM MODE COLOR		Green, scarlet, pink, sky blue, violet, pale yellow, pale green, light blue, white (black)
	BACKGROUND		BLACK, WHITE
RECORD SETUP (For the optional recorder module)	MANUAL RECORD		REAL TIME, DELAY
	MANUAL RECORD TIME		CONTINUOUS, 10 sec, 20 sec, 30 sec
	PERIODIC FREE INTERVAL		1 to 120 min (1 min steps), 15 min
OTHER SETUP	SYNC SOUND PITCH		LOW, MIDDLE, HIGH
	ALARM INDICATOR QRS SYNC		ON, OFF OR, NICU: OFF ICU: ON
	ZB-900P TYPE		8, A
	TIME ZONE		0 to ±12:00 in 30 min steps, +9:00
	EXTERNAL OUTPUT		ECG ANALOG OUT, QRS SYNC SIGNAL, ALARM CRISIS, ALARM CRISIS & WARNING
ALARM MASTER	VITAL		See explanation in following pages.
	ARRHYTHMIA		See explanation in following pages.
	GAS		See explanation in following pages.
ARRHYTHMIA RECALL MASTER			See explanation in following pages.
NETWORK SETUP**	GROUP		General, CCU, CCU-1, CCU-2, ER, ICU, ICU-1, ICU-2, OR, Post CCU, Recovery, Tele-1, Tele-2, Tele-3, Tele-4, Tele-5
	DEFAULT GATEWAY		255.255.255.255, 000.000.000.000
	IP ADDRESS SETUP		AUTO, MANUAL
	MANUAL IP ADDRESS		255.255.255.255, 010.000.000.001
	MANUAL SUBNET MASK		255.255.255.255, 255.000.000.000
PRINTER SETUP	PRINTER SETUP	PAPER SIZE	A4, LETTER
		PRINTER TYPE	MONOCHROME, COLOR
		IP ADDRESS	255.255.255.255, 000.000.000.000
	PRINTER NAME		Up to 8 alphanumerics, lp
	HOSPITAL NAME		Up to 32 alphanumerics
EXT I/F SETUP			RS-232C information of the interface connected to the monitor. Refer to the interface manual.

** These items can only be set when the optional QI-101P network card or QI-111P network printer card is installed in the monitor.

Site Setting (SITE)


*** SYSTEM SETUP ***
SITE
OR
ICU
NICU
SET
DISPLAY SETUP
BED ID SETUP
PARAMETER SETUP
ALARM SETUP
UNITS SETUP
COLOR SETUP
RECORD SETUP
OTHER SETUP
ALARM MASTER
ARRHYTHMIA RECALL MASTER
NETWORK SETUP
PRINTER SETUP
EXT I/F SETUP
RETURN


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
HR
80
VPC
0 /m
ST
0.00 mV
ICU MODE
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
ENLARGED
SLEEP MODE
SYSTEM SETT
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
REC

SITE: OR, ICU, NICU

Select the site according to the environment. The default settings, including alarm upper and lower limit settings, differ according to site.

OR: The “BYPASS” key is displayed on the MENU window. Sleep mode is not available.

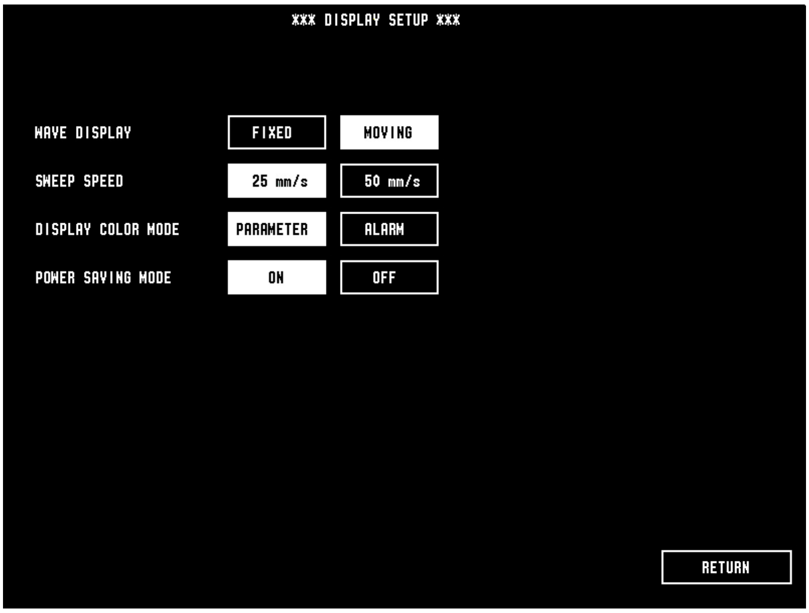
ICU, NICU: The “SUSPEND MONITORING” key is displayed on the MENU window. Sleep mode is available.

When “ALL ALARMS OFF” is selected for ALARMS OFF TYPE on the ALARM SETUP screen, the “ALL ALARMS OFF” key is displayed instead of the “BYPASS” or “SUSPEND MONITORING” key on the MENU window. Refer to the “Alarms Settings” section.

For details on the functions of the “BYPASS”, “SUSPEND MONITORING” and “ALL ALARMS OFF” keys, refer to “Silencing and Suspending Alarms” in Section 6.

To change the site, select the new site and touch the “SET” key. When the site is changed, some settings whose factory default settings differ according to site return to the factory default settings for the new site. Other settings do not change.

Display Settings (DISPLAY SETUP)



*** DISPLAY SETUP ***

WAVE DISPLAY FIXED [✓ MOVING]
SWEEP SPEED [✓ 25 mm/s] 50 mm/s
DISPLAY COLOR MODE [✓ PARAMETER] ALARM
POWER SAVING MODE [✓ ON] OFF

WAVE DISPLAY: FIXED, MOVING

Set waveform sweep mode and trendgraph display on the monitoring screen on or off.

FIXED: Waveform is fixed and renewed from the left. Trendgraph or OCRG cannot be displayed on the monitoring screen.
MOVING: Waveform sweeps from the right. Trendgraph or OCRG can be displayed on the monitoring screen.

SWEEP SPEED: 25 mm/s, 50 mm/s

Select waveform sweep speed.

DISPLAY COLOR MODE: PARAMETER, ALARM

There are two color display modes.

PARAMETER: A different color can be set for each parameter. When an alarm occurs, the alarmed parameter data is highlighted.
ALARM: The same color selected at ALARM MODE COLOR of the COLOR SETUP is set for all parameters. When an alarm occurs, the alarmed parameter color changes to red or yellow according to the alarm level set at ALARM LEVEL of the ALARM SETUP.

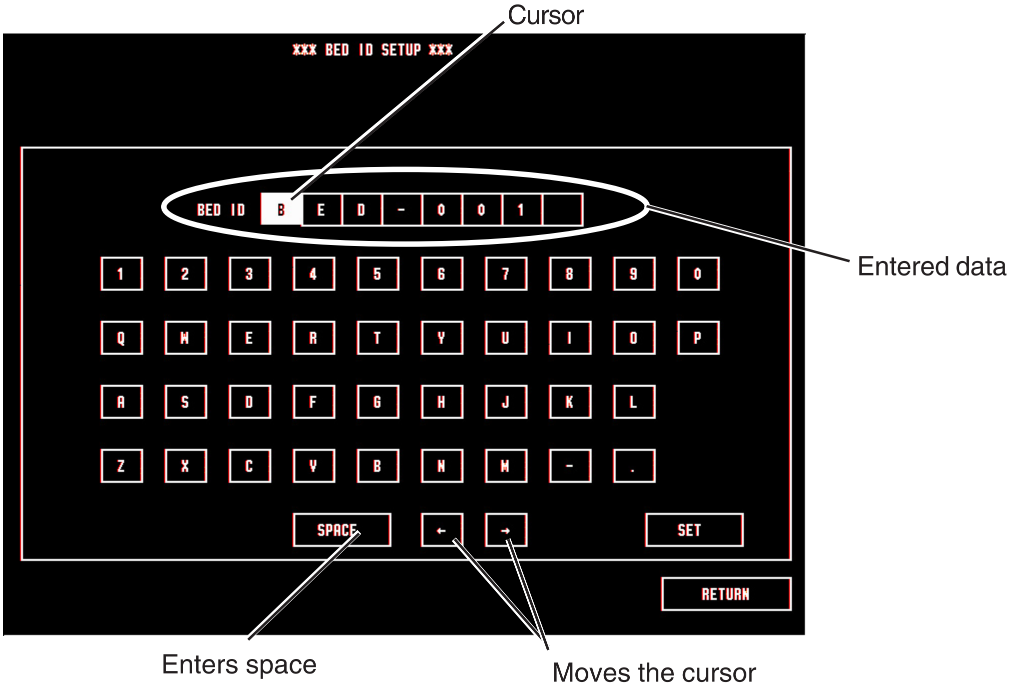
CRISIS: red
WARNING: yellow
ADVISORY: yellow

POWER SAVING MODE: ON, OFF

When operating the monitor on battery power, the brightness of the screen can be adjusted to save battery power.

ON: Dim, longer battery operation time
OFF: Normal screen brightness, shorter battery operation time

Bed ID Setting (BED ID SETUP)


*** BED ID SETUP ***
1 2 3 4 5 6 7 8 9 0
Q W E R T Y U I O P
A S D F G H J K L
Z X C V B N M - .
SPACE
←
→
SET
RETURN

BED ID B E D - 0 0 1

Cursor

Entered data

Enters space

Moves the cursor

Enter an identification name for the bed. Up to 8 alphanumeric characters can be entered.

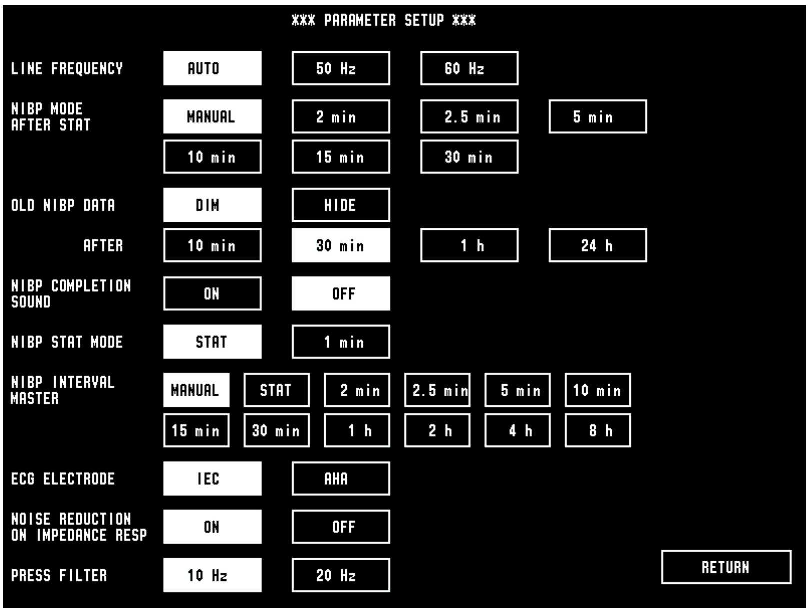
CAUTION

When the monitor is connected to a central monitor network, set the Bed ID on the monitor to correctly identify the bed on the central monitor.

---

1. Touch the desired letters and numbers to enter the bed ID.
2. Touch the “SET” key to register the bed ID.
3. Touch the “RETURN” key to return to the SYSTEM SETUP screen.

Parameter and Other Settings (PARAMETER SETUP)


*** PARAMETER SETUP ***
LINE FREQUENCY
AUTO
50 Hz
60 Hz
NIBP MODE AFTER STAT
MANUAL
2 min
2.5 min
5 min
10 min
15 min
30 min
OLD NIBP DATA
DIM
HIDE
AFTER
10 min
30 min
1 h
24 h
NIBP COMPLETION SOUND
ON
OFF
NIBP STAT MODE
STAT
1 min
NIBP INTERVAL MASTER
MANUAL
STAT
2 min
2.5 min
5 min
10 min
15 min
30 min
1 h
2 h
4 h
8 h
ECG ELECTRODE
IEC
AHA
NOISE REDUCTION ON IMPEDANCE RESP
ON
OFF
PRESS FILTER
10 Hz
20 Hz
RETURN

LINE FREQUENCY: AUTO, 50 Hz, 60 Hz

Select line frequency. In normal use, set to AUTO. This setting is not available on the BSM-2304 monitor.

NOTE

When operating on battery, make sure that the appropriate line frequency is selected. Otherwise, noise may interfere on the pulse waveform.

AUTO:	Automatically detects the AC line frequency
50 Hz:	Set to 50 when operating on battery only in a 50 Hz area
60 Hz:	Set to 60 when operating on battery only in a 60 Hz area

NIBP MODE AFTER STAT: MANUAL, 2, 2.5, 5, 10, 15, 30 min

The NIBP measurement mode after completing STAT (continuous) measurement changes to the Manual mode or Auto mode with the selected interval.

OLD NIBP DATA: DIM, HIDE
AFTER: 10 min, 30 min, 1 h, 24 h

Select whether to dim or hide the NIBP data after NIBP measurement and how long to wait after NIBP measurement to dim or hide it.

NIBP COMPLETION SOUND: ON, OFF

ON: When NIBP measurement is completed, one “bong” sounds.
OFF: No sound. However, when the STAT mode is selected for the NIBP measurement, one “bong” sounds after completing STAT measurement.

NIBP STAT MODE: STAT, 1 min

There are two modes for STAT NIBP measurement.
STAT: Measure NIBP as many times as possible over a 15 minute period.
1 min: Measure NIBP every minute for a 15 minute period.

NIBP INTERVAL MASTER: MANUAL, STAT, 2, 2.5, 5, 10, 15, 30 min, 1, 2, 4 or 8 h

Select the NIBP measurement mode to be set when the monitor is turned off for more than 30 minutes, the monitor is initialized or the data is deleted on the DELETE ALL window.

ECG ELECTRODE: IEC, AHA

Select the electrode lead type.

IEC: R, L, F, RF, C
AHA: RA, LA, LL, RL, V

NOISE REDUCTION ON IMPEDANCE RESP: ON, OFF

In the impedance method, noise from the heart beat may interfere on the respiration waveform due to electrode position, and the respiration rate may increase to almost the same rate as the heart rate. In such a case, set this setting to ON to reduce noise interference on the respiration waveform.

If the respiration rate is miscounted in the thermistor method, set this item to OFF.

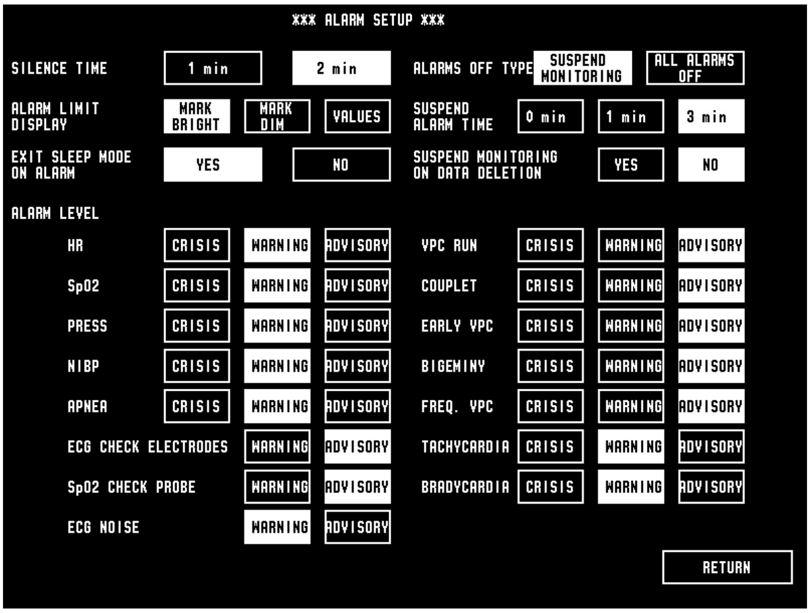
NOTE

When this item is set to ON and the timing of the respiration and heart beat coincide, respiration rate may not be counted. In such a case, set this item to OFF or check the patient's respiration by observing the patient's chest movement or the respiration waveform on the monitoring screen.

PRESS FILTER: 10 Hz, 20 Hz

Select the noise filter for IBP monitoring. For normal monitoring, set the filter to 10 Hz. To see the IBP waveforms in detail, set the filter to 20 Hz.

Alarm Settings (ALARM SETUP)


*** ALARM SETUP ***
SILENCE TIME
1 min
2 min
ALARMS OFF TYPE
SUSPEND MONITORING
ALL ALARMS OFF
ALARM LIMIT DISPLAY
MARK BRIGHT
MARK DIM
VALUES
SUSPEND ALARM TIME
0 min
1 min
3 min
EXIT SLEEP MODE ON ALARM
YES
NO
SUSPEND MONITORING ON DATA DELETION
YES
NO
ALARM LEVEL
HR
CRISIS
WARNING
ADVISORY
VPC RUN
CRISIS
WARNING
ADVISORY
SpO2
CRISIS
WARNING
ADVISORY
COUPLET
CRISIS
WARNING
ADVISORY
PRESS
CRISIS
WARNING
ADVISORY
EARLY VPC
CRISIS
WARNING
ADVISORY
NIBP
CRISIS
WARNING
ADVISORY
BIGEMINY
CRISIS
WARNING
ADVISORY
APNEA
CRISIS
WARNING
ADVISORY
FREQ. VPC
CRISIS
WARNING
ADVISORY
ECG CHECK ELECTRODES
WARNING
ADVISORY
TACHYCARDIA
CRISIS
WARNING
ADVISORY
SpO2 CHECK PROBE
WARNING
ADVISORY
BRADYCARDIA
CRISIS
WARNING
ADVISORY
ECG NOISE
WARNING
ADVISORY
RETURN

SILENCE TIME: 1 min, 2 min

The interval for suspending an alarm can be selected.

ALARM LIMIT DISPLAY: MARK BRIGHT, MARK DIM, VALUES

MARK BRIGHT:	The 🔕 Vital Signs Alarm Off mark in normal brightness is displayed beside the parameter values whose vital signs alarm is set to OFF.
MARK DIM:	The 🔕 Vital Signs Alarm Off mark is displayed dimmed beside the parameter values whose vital signs alarm is set to OFF.
VALUES:	The upper/lower alarm limits are displayed beside parameter values. When the limit is set to OFF, "OFF" is displayed.

EXIT SLEEP MODE ON ALARM: YES, NO

WARNING

When EXIT SLEEP MODE ON ALARM is set NO, the bedside monitor alarm cannot be seen or heard on the bedside monitor during sleep mode, Monitor the bedside monitor alarm on the central monitor or telemetry system. Otherwise, the bedside monitor alarm may be overlooked.

YES:	When an alarm occurs during sleep mode, the sleep mode is exited and the monitoring screen appears.
NO:	The sleep mode continues even when an alarm occurs.

ALARMS OFF TYPE: BYPASS/SUSPEND MONITORING, ALL ALARMS OFF

WARNING

Before setting ALARMS OFF TYPE, consult the administrator of this monitor in your facility. Before selecting "ALL ALARMS OFF" or "BYPASS", all operators must thoroughly understand the function of the "ALL ALARMS OFF" key and "BYPASS" key which turn all alarms off for an indefinite period.

Select the type of all alarms off. The key for the selected type appears on the MENU window. The "SUSPEND MONITORING" key is available in ICU or NICU mode. The "BYPASS" key is available in OR mode.

SUSPEND MONITORING:	When you temporarily stop patient monitoring for examinations, you can use this key. When this key is pressed, all alarms and NIBP STAT and Auto measurements are suspended. Alarms resume when the "SUSPEND MONITORING" key is pressed again or when heart rate, SpO_2, IBP or $EtCO_2$ is monitored for the SUSPEND ALARM TIME or when NIBP is measured.
BYPASS:	When the patient is connected to a heart-lung machine, you can use this key. When this key is pressed, all alarms and NIBP STAT and Auto measurements are indefinitely suspended. Alarms resume when the "BYPASS" key is pressed again.

ALL ALARMS OFF:	When this key is pressed, all alarms are indefinitely suspended. Alarms resume when the "ALL ALARMS OFF" key is pressed again.

SUSPEND ALARM TIME

Select when to release monitoring suspension and resume alarms when the "SUSPEND MONITORING" key on the MENU window is pressed in ICU/NICU mode or "YES" key on the DELETE ALL window is pressed when SUSPEND MONITORING ON DATA DELETION is set to YES.

0 min:	Alarms resume immediately when heart rate, SpO_2, IBP or $EtCO_2$ is monitored or when NIBP is measured.
1 min:	Alarms resume when heart rate, SpO_2, IBP or $EtCO_2$ is monitored properly for 1 minute or when NIBP is measured.
3 min:	Alarms resume when heart rate, SpO_2, IBP or $EtCO_2$ is monitored properly for 3 minutes or when NIBP is measured.

SUSPEND MONITORING ON DATA DELETION

Select whether to enter standby mode when the "YES" key is pressed on the DELETE ALL window. During standby mode, all alarms are suspended. Alarms resume when heart rate, SpO_2, IBP or $EtCO_2$ is monitored properly for the interval set for SUSPEND ALARM TIME or when NIBP is measured.

YES:	Deletes data and enters standby mode
NO:	Deletes data and does not enter standby mode

HR ALARM LEVEL: CRISIS, WARNING, ADVISORY

Heart rate alarm level and alarm indicator color can be selected. See "Alarm Indications" in Section 6.

CRISIS:	The heart rate data is highlighted with a continuous "pip" sound and red blinking lamp.
WARNING:	The heart rate data is highlighted with a continuous "bing bong" sound and yellow blinking lamp.
ADVISORY:	The heart rate data is highlighted with a "bong" sound every 20 seconds and yellow lamp lit.

SpO2 ALARM LEVEL: CRISIS, WARNING, ADVISORY

SpO_2 alarm level and alarm indicator color can be selected. When the sync sound is synchronizing with the SpO_2 pulse, the pulse rate alarm level is also set. See "Alarm Indications" in Section 6.

CRISIS:	The SpO_2 and pulse rate data are highlighted with a continuous "pip" sound and red blinking lamp.
WARNING:	The SpO_2 and pulse rate data are highlighted with a continuous "bing bong" sound and yellow blinking lamp.
ADVISORY:	The SpO_2 and pulse rate data are highlighted with a "bong" sound every 20 seconds and yellow lamp lit.

PRESS ALARM LEVEL: CRISIS, WARNING, ADVISORY

IBP alarm level and alarm indicator color can be selected. When the sync sound is synchronized with the blood pressure pulse, the pulse rate alarm level is also set. See "Alarm Indications" in Section 6.

CRISIS:	The IBP and pulse rate data are highlighted with a continuous “pip” sound and red blinking lamp.
WARNING:	The IBP and pulse rate data are highlighted with a continuous “bing bong” sound and yellow blinking lamp.
ADVISORY:	The IBP and pulse rate data are highlighted with a “bong” sound every 20 seconds and yellow lamp lit.

NIBP ALARM LEVEL: CRISIS, WARNING, ADVISORY

NIBP alarm level and alarm indicator color can be selected. See “Alarm Indications” in Section 6.

CRISIS:	The NIBP data are highlighted with a continuous “pip” sound and red blinking lamp.
WARNING:	The NIBP data are highlighted with a continuous “bing bong” sound and yellow blinking lamp.
ADVISORY:	The NIBP data are highlighted with a “bong” sound every 20 seconds and yellow lamp lit.

APNEA ALARM LEVEL: CRISIS, WARNING, ADVISORY

APNEA alarm level and alarm indicator color can be selected. See “Alarm Indications” in Section 6.

CRISIS:	The “APNEA” message is highlighted with a continuous “pip” sound and red blinking lamp.
WARNING:	The “APNEA” message is highlighted with a continuous “bing bong” sound and yellow blinking lamp.
ADVISORY:	The “APNEA” message is highlighted with a “bong” sound every 20 seconds and yellow lamp lit.

ECG CHECK ELECTRODES ALARM LEVEL: WARNING, ADVISORY

CHECK ELECTRODES alarm level and alarm indicator color can be selected. See “Alarm Indications” in Section 6.

WARNING:	The “CHECK ELECTRODES ” message is highlighted with a continuous “bing bong” sound and yellow blinking lamp.
ADVISORY:	The “CHECK ELECTRODES ” message is highlighted with a “bong” sound every 20 seconds and yellow lamp lit.

SpO$_2$ CHECK PROBE ALARM LEVEL: WARNING, ADVISORY

The alarm level and alarm indicator color for the CHECK PROBE and CANNOT DETECT PULSE alarm can be selected. See “Alarm Indications” in Section 6.

WARNING:	The SpO2 ALARM message is highlighted with a continuous “bing bong” sound and yellow blinking lamp.
ADVISORY:	The SpO2 ALARM message is highlighted with a “bong” sound every 20 seconds and yellow lamp lit.

ECG NOISE ALARM LEVEL: WARNING, ADVISORY

ECG NOISE alarm level and alarm indicator color can be selected. The alarm occurs if noise continues for more than 30 seconds. See “Alarm Indications” in Section 6.

WARNING:	The “NOISE” message is highlighted with a continuous “bing bong” sound and yellow blinking lamp.

ADVISORY: The “NOISE” message is highlighted with a “bong” sound every 20 seconds and yellow lamp lit.

VPC RUN, COUPLET, EARLY VPC, BIGEMINY, FREQ VPC ALARM LEVEL: CRISIS, WARNING, ADVISORY

The alarm level and alarm indicator color for the VPC RUN, COUPLET, EARLY VPC, BIGEMINY and FREQ VPC arrhythmias can be selected individually. See “Alarm Indications” in Section 6.

CRISIS: The arrhythmia message is highlighted with a continuous “pip” sound and red blinking lamp.

WARNING: The arrhythmia message is highlighted with a continuous “bing bong” sound and yellow blinking lamp.

ADVISORY: The arrhythmia message is highlighted with a “bong” sound every 20 seconds and yellow lamp lit.

TACHYCARDIA, BRADYCARDIA ALARM LEVEL: CRISIS, WARNING, ADVISORY

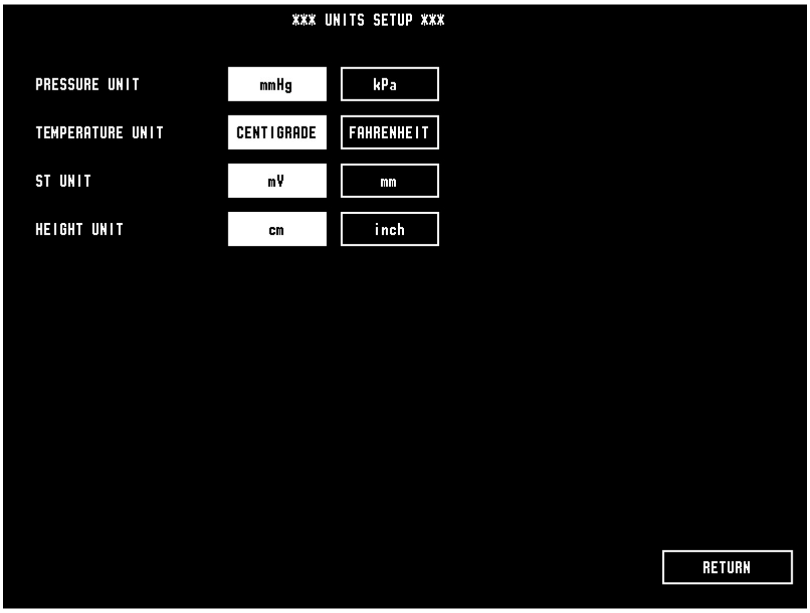
The alarm level and alarm indicator color for the TACHYCARDIA and BRADYCARDIA arrhythmias can be selected. See “Alarm Indications” in Section 6. When the heart rate alarm level and tachycardia or bradycardia alarm level differ, the higher level is used.

CRISIS: The arrhythmia message is highlighted with a continuous “pip” sound and red blinking lamp.

WARNING: The arrhythmia message is highlighted with a continuous “bing bong” sound and yellow blinking lamp.

ADVISORY: The arrhythmia message is highlighted with a “bong” sound every 20 seconds and yellow lamp lit.

Unit Settings (UNITS SETUP)



PRESSURE UNIT: mmHg/kPa

Select the unit for NIBP, IBP and CO_2.

TEMPERATURE UNIT: CENTIGRADE, FAHRENHEIT

Select the unit for temperature.

ST UNIT: mV, mm

Select the unit for ST level.

HEIGHT UNIT: cm, inch

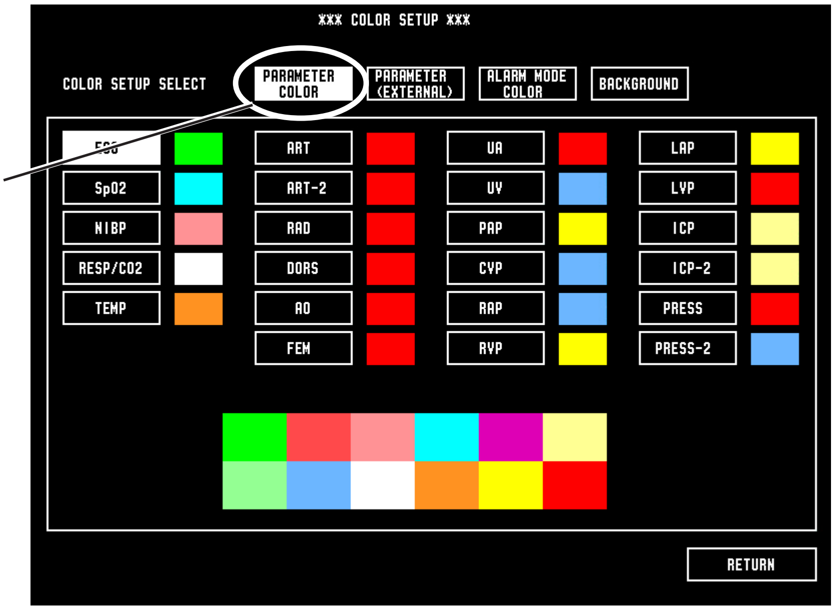
Select the unit for continuous NIBP.

Color Settings (COLOR SETUP)

PARAMETER COLOR

The color for each parameter display can be selected. Available colors are: green, scarlet, pink, sky blue, violet, pale yellow, pale green, light blue, white(black), orange, yellow and red.

To display the parameters in different colors, the DISPLAY COLOR MODE of the DISPLAY SETUP must be set to PARAMETER.


*** COLOR SETUP ***
COLOR SETUP SELECT
PARAMETER COLOR
PARAMETER (EXTERNAL)
ALARM MODE COLOR
BACKGROUND
ECG
SpO2
NIBP
RESP/CO2
TEMP
ART
ART-2
RAD
DORS
AO
FEM
UA
UV
PAP
CVP
RAP
RVP
LAP
LVP
ICP
ICP-2
PRESS
PRESS-2
RETURN

Selected parameter

1. Touch the “PARAMETER COLOR” key.

2. Touch the parameter you want to set the color to.
   ART-2, ICP-2 and PRESS-2 are not available on BSM-2301/2351.

3. Touch the desired color for the parameter.

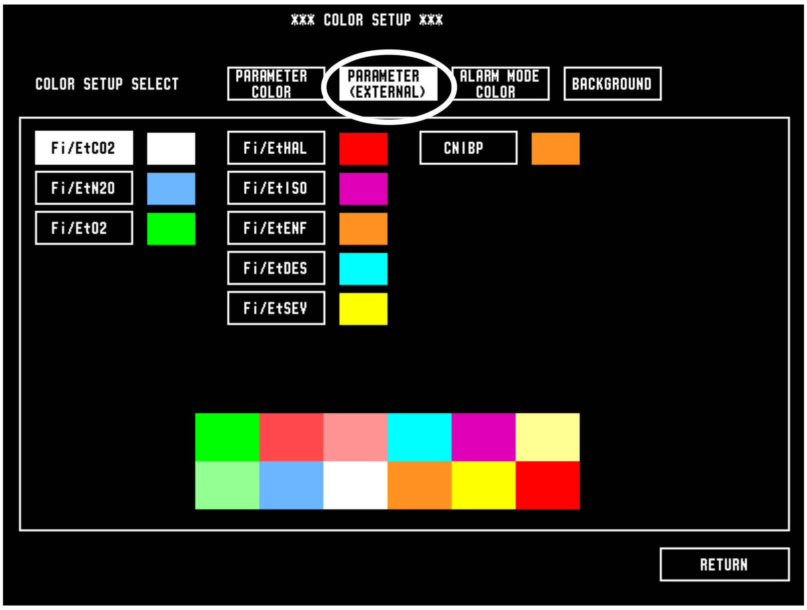
4. Repeat steps 2 and 3 to set a color for other parameters.

PARAMETER (EXTERNAL)

The display color for parameters monitored by an external device can be selected. Available colors are: green, scarlet, pink, sky blue, violet, pale yellow, pale green, light blue, white (black), orange, yellow and red.

To display the parameters in different colors, the DISPLAY COLOR MODE of the DISPLAY SETUP must be set to PARAMETER.

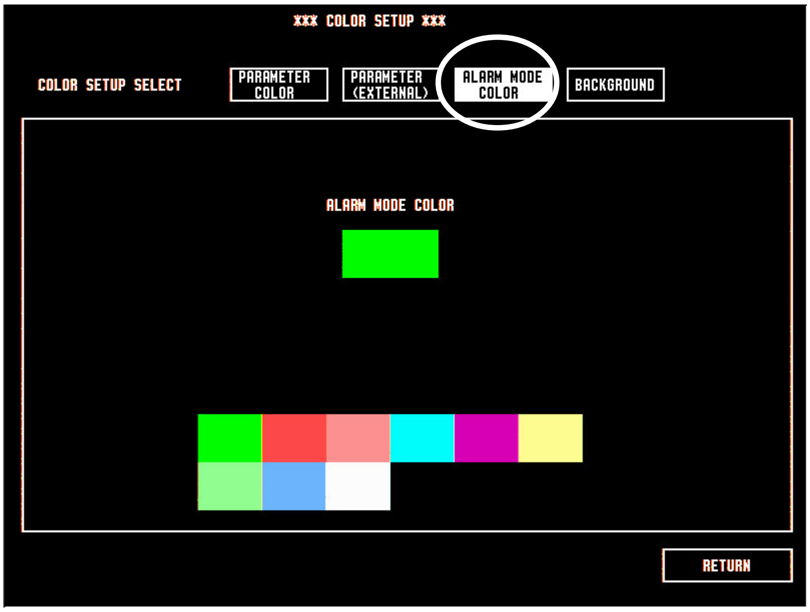
The setting procedure is the same as PARAMETER COLOR.


*** COLOR SETUP ***
COLOR SETUP SELECT
PARAMETER COLOR
PARAMETER (EXTERNAL)
ALARM MODE COLOR
BACKGROUND
Fi/EtCO2
Fi/EtN2O
Fi/EtO2
Fi/EtHAL
Fi/EtISO
Fi/EtENF
Fi/EtDES
Fi/EtSEV
CNIBP
RETURN

ALARM MODE COLOR

The color for all parameters display can be selected. When ALARM is selected for the DISPLAY COLOR MODE of the DISPLAY SETUP, all parameters are displayed in the same color. Available colors are: green, scarlet, pink, sky blue, violet, pale yellow, pale green, light blue and white.

When an alarm occurs, the alarmed parameter changes to red or yellow according to the alarm level set at ALARM LEVEL of the ALARM SETUP.

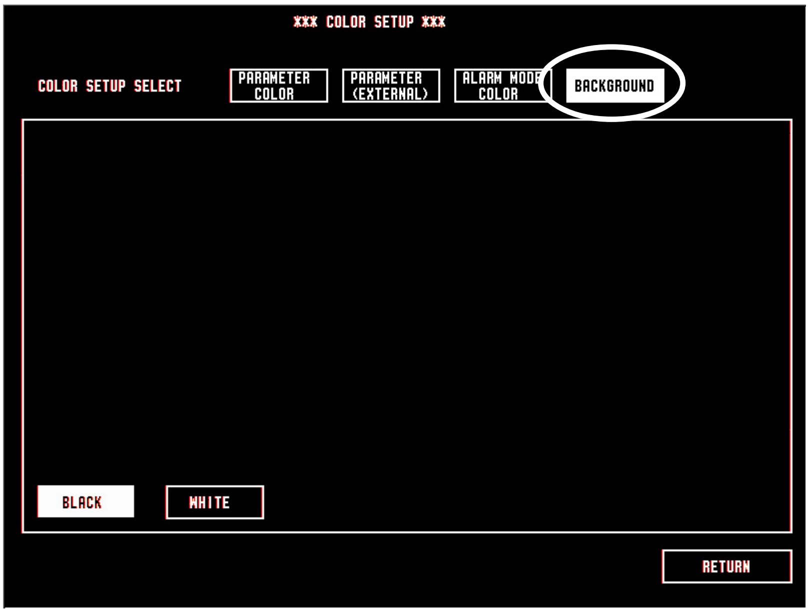

*** COLOR SETUP ***
COLOR SETUP SELECT
PARAMETER COLOR
PARAMETER (EXTERNAL)
ALARM MODE COLOR
BACKGROUND
ALARM MODE COLOR
RETURN

1. Touch the "ALARM MODE COLOR" key.

2. Touch the desired color.

BACKGROUND: BLACK, WHITE

The background color of the monitoring screen can be selected.

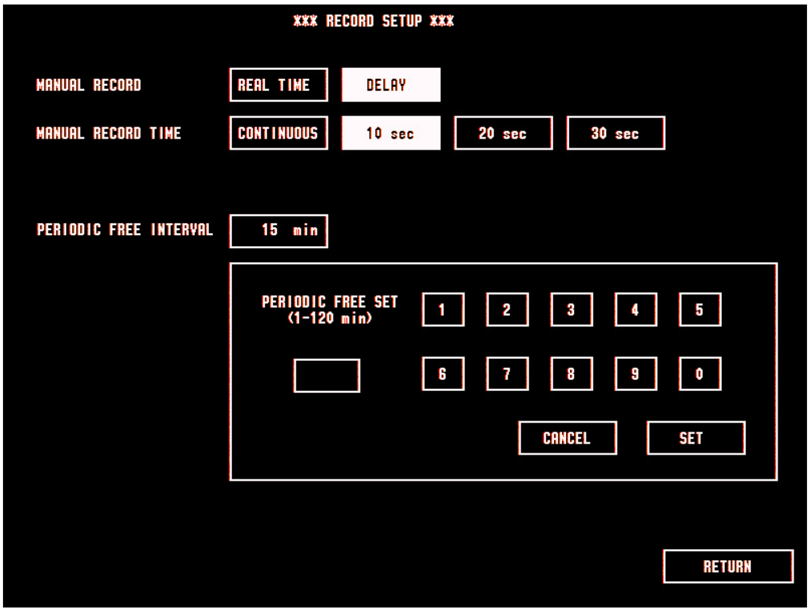

*** COLOR SETUP ***
COLOR SETUP SELECT
PARAMETER COLOR
PARAMETER (EXTERNAL)
ALARM MODE COLOR
BACKGROUND
BLACK
WHITE
RETURN

1. Touch the “BACKGROUND” key.

2. Touch the “BLACK” or “WHITE” key.

Recording Settings (RECORD SETUP)

These setting items are for when using an optional WS-231P recorder module.


*** RECORD SETUP ***
MANUAL RECORD
REAL TIME
DELAY
MANUAL RECORD TIME
CONTINUOUS
10 sec
20 sec
30 sec
PERIODIC FREE INTERVAL
15 min
PERIODIC FREE SET (1-120 min)
1
2
3
4
5
6
7
8
9
0
CANCEL
SET
RETURN

MANUAL RECORD: REAL TIME, DELAY

There are two manual recording modes.

REAL TIME:	The beginning of the recorded waveform is when the record key on the recorder module is pressed.
DELAY:	The beginning of the recorded waveform is 8 seconds before the record key on the recorder module is pressed.

MANUAL RECORD TIME: CONTINUOUS, 10 sec, 20 sec, 30 sec

Select the length for manual recording. When CONTINUOUS is selected, the recording starts and stops when the record key on the recorder module is pressed.

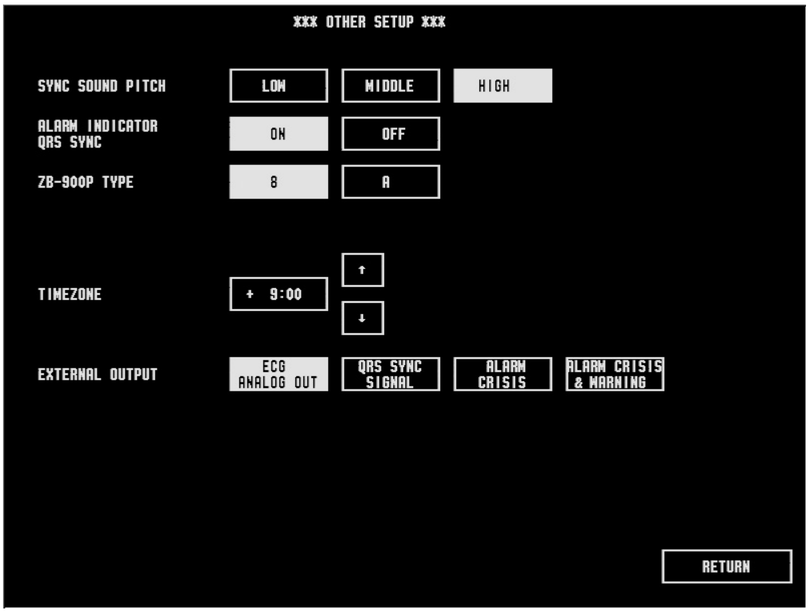
PERIODIC FREE INTERVAL: 1 to 120 min

You can select the FREE time interval from 1 to 120 min in 1 min steps for periodic recording. See “Setting Periodic Recording” in Section 8.

1. Enter the numbers by touching the number keys.

2. Touch the “SET” key to enter the value.

Other Settings (OTHER SETUP)


*** OTHER SETUP ***
SYNC SOUND PITCH
LOW
MIDDLE
HIGH
ALARM INDICATOR QRS SYNC
ON
OFF
ZB-900P TYPE
8
A
TIMEZONE
+ 9:00
↑
↓
EXTERNAL OUTPUT
ECG ANALOG OUT
QRS SYNC SIGNAL
ALARM CRISIS
ALARM CRISIS & WARNING
RETURN

SYNC SOUND PITCH: LOW, MIDDLE, HIGH

High, middle, or low pitch synchronized sound can be selected.

ALARM INDICATOR QRS SYNC: ON, OFF

ON: The green lamp blinks in synchronization with the QRS.
OFF: The alarm indicator does not blink.

ZB-900P TYPE: 8, A

Not available.

TIME ZONE: 0 to ±12:00

Set the time zone in respect to GMT (Greenwich Mean Time). The time difference can be selected in 30 minute steps.

This setting must be the same on all monitors in the same network. Otherwise data communication problems may occur.

EXTERNAL OUTPUT

Select the type of signal to output from the monitor to the external instrument connected to the monitor. To output a signal from the monitor, the optional QI-231P interface is required.

ECG ANALOG OUT:	ECG analog signal is output
QRS SYNC SIGNAL:	Signal synchronized with QRS is output
ALARM CRISIS:	A trigger signal is output when an alarm of crisis level occurs
ALARM CRISIS & WARNING:	A trigger signal is output when an alarm of crisis or warning level occurs

Alarm Master Settings (ALARM MASTER)

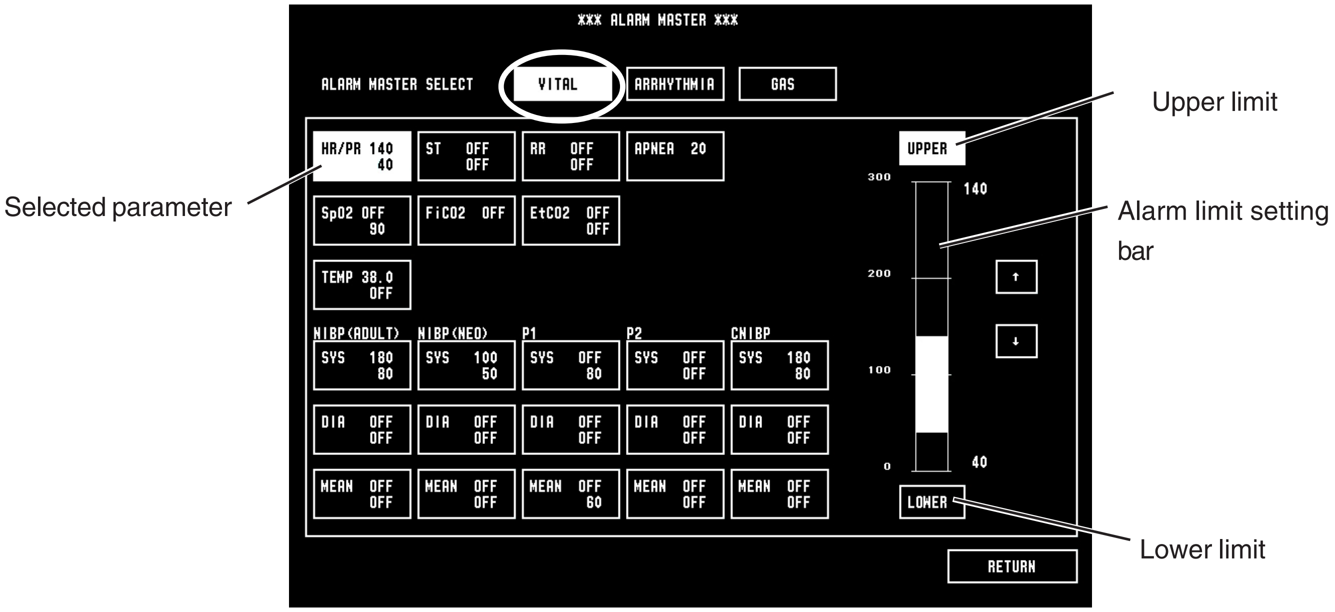
For fast and easy alarm setup, a group of alarm items can be set all together at one time. For example, there may be typical alarm settings at your hospital, or you may have certain alarm settings for certain patients.

Even when alarms are set by an alarm master, individual alarm settings in the alarm master can still be changed on the VITAL ALARM or ARRHYTH ALARM window or the alarm setting in each parameter setup window.

VITAL ALARM MASTER

Set the vital alarm master settings. If the upper limit is set to a value above the maximum or the lower limit is set to a value below the minimum, the alarm for that upper/lower limit is automatically set to OFF.

1. Touch the “VITAL” key.



*** ALARM MASTER ***
ALARM MASTER SELECT
VITAL
ARRHYTHMIA
GAS
HR/PR 140 40
ST OFF OFF
RR OFF OFF
APNEA 20
SpO2 OFF 90
FiCO2 OFF
EtCO2 OFF OFF
TEMP 38.0 OFF
NIBP(ADULT)
SYS 180 80
DIA OFF OFF
MEAN OFF OFF
NIBP(NEO)
SYS 100 50
DIA OFF OFF
MEAN OFF OFF
P1
SYS OFF 80
DIA OFF OFF
MEAN OFF 60
P2
SYS OFF OFF
DIA OFF OFF
MEAN OFF OFF
CNIBP
SYS 180 80
DIA OFF OFF
MEAN OFF OFF
UPPER
300
200
100
0
140
40
↑
↓
LOWER
RETURN
Upper limit
Selected parameter
Alarm limit setting bar
Lower limit

2. Touch the parameter you want to change the alarm setting for. P2 is not available on BSM-2301/2351.

3. Touch the “UPPER” key to set the upper limit or touch the “LOWER” key to set the lower limit.

4. Touch the desired level on the setting bar. Touch the ↑ or ↓ key to adjust the setting.

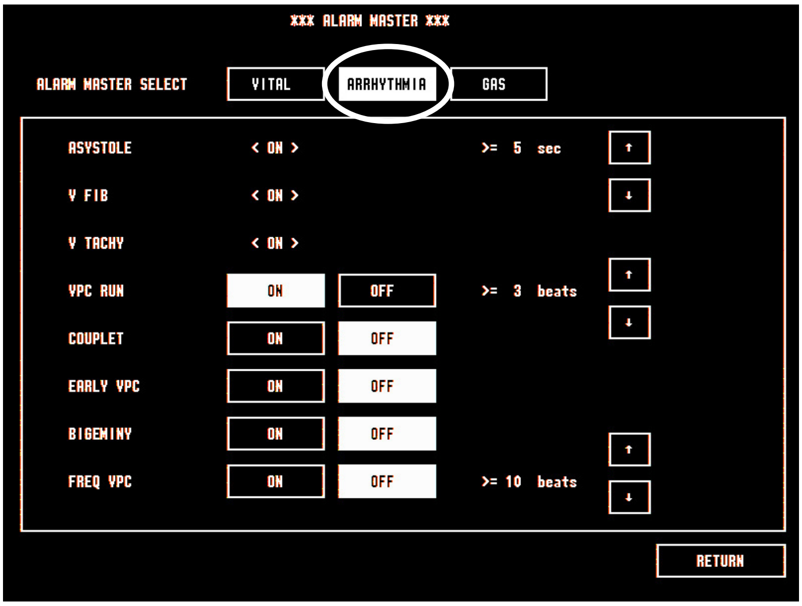
   If the upper limit is set to a value above the maximum or the lower limit is set to a value below the minimum, the alarm is set to OFF.

5. Repeat steps 2 to 4 to change other parameter alarm settings.

ARRHYTHMIA ALARM MASTER

Set the arrhythmia alarm master settings.

1. Touch the “ARRHYTHMIA” key.


*** ALARM MASTER ***
ALARM MASTER SELECT
VITAL
ARRHYTHMIA
GAS
↑
↓
RETURN

ASYSTOLE < ON > >= 5 sec
V FIB < ON >
V TACHY < ON >
VPC RUN ON OFF >= 3 beats
COUPLET ON OFF
EARLY VPC ON OFF
BIGEMINY ON OFF
FREQ VPC ON OFF >= 10 beats

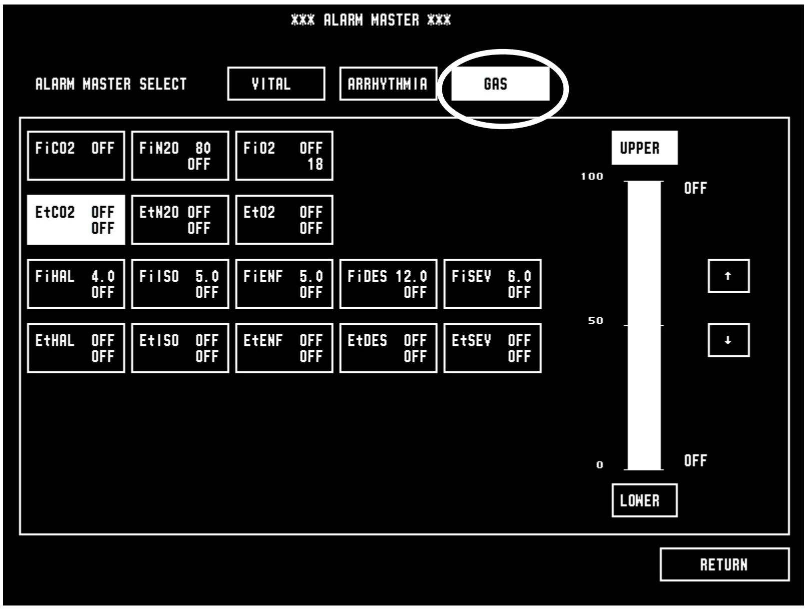
2. Touch the “ON” or “OFF” key for each arrhythmia type to set it on or off.

3. For “ASYSTOLE”, “VPC RUN” and “FREQ VPC”, set the detecting condition with the ↑ or ↓ key.

GAS ALARM MASTER

Set the gas alarm master settings. If the upper limit is set to a value above the maximum or the lower limit is set to a value below the minimum, the alarm for that upper/lower limit is automatically set to OFF.

1. Touch the “GAS” key.


*** ALARM MASTER ***
ALARM MASTER SELECT
VITAL
ARRHYTHMIA
GAS
UPPER
100
OFF
50
0
OFF
LOWER
↑
↓
RETURN

FiCO2 OFF
FiN2O 80 OFF
FiO2 OFF 18
EtCO2 OFF OFF
EtN2O OFF OFF
EtO2 OFF OFF
FiHAL 4.0 OFF
FiISO 5.0 OFF
FiENF 5.0 OFF
FiDES 12.0 OFF
FiSEV 6.0 OFF
EtHAL OFF OFF
EtISO OFF OFF
EtENF OFF OFF
EtDES OFF OFF
EtSEV OFF OFF

2. Touch the parameter you want to change the alarm setting for.

3. Touch the “UPPER” key to set the upper limit or touch the “LOWER” key to set the lower limit.

4. Touch the desired level on the setting bar. Touch the ↑ or ↓ key to adjust the setting.

   If the upper limit is set to a value above the maximum or the lower limit is set to a value below the minimum, the alarm is set to OFF.

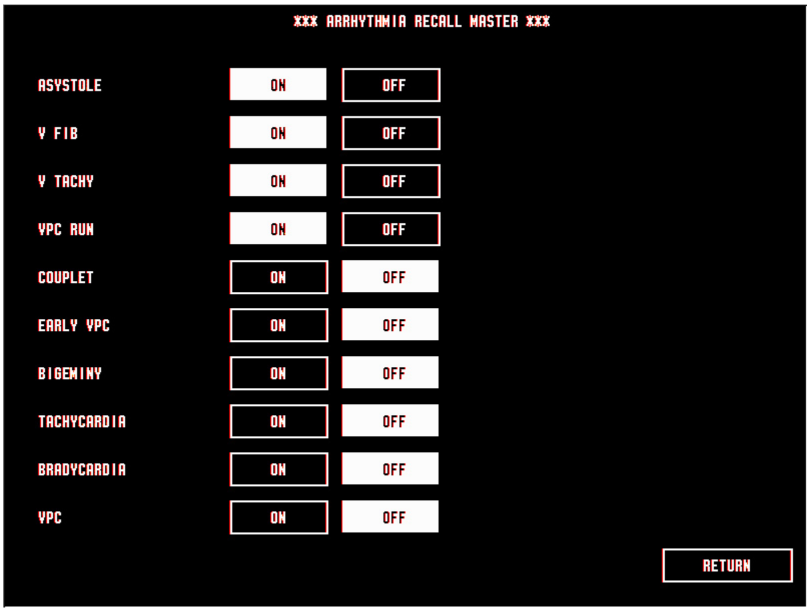
5. Repeat steps 2 to 4 to change other parameter alarm settings.

Arrhythmia Recall Master Settings (ARRHYTHMIA RECALL MASTER)

For fast and easy arrhythmia recall setup, a group of arrhythmia recall items can be set all together at one time.

Even when arrhythmia recall is set by an arrhythmia recall master, individual settings in the arrhythmia recall settings can still be changed on the ARRHYTH RECALL window.

Touch the “ON” or “OFF” key for an individual arrhythmia type to set it on or off for creating arrhythmia recall files.



*** ARRHYTHMIA RECALL MASTER ***

ASYSTOLE [✓ ON] OFF
V FIB [✓ ON] OFF
V TACHY [✓ ON] OFF
VPC RUN [✓ ON] OFF
COUPLET ON [✓ OFF]
EARLY VPC ON [✓ OFF]
BIGEMINY ON [✓ OFF]
TACHYCARDIA ON [✓ OFF]
BRADYCARDIA ON [✓ OFF]
VPC ON [✓ OFF]

Network Settings (NETWORK SETUP)

Change the network settings when using the optional QI-101P network card or QI-111P network printer card. For details, contact your Nihon Kohden distributor.

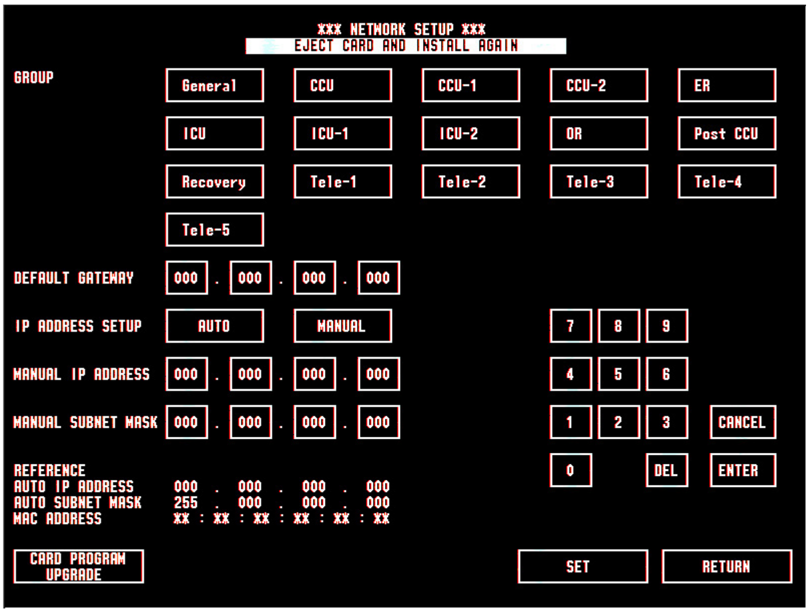
The "CARD PROGRAM UPGRADE" key is for upgrading the QI-101P network card and QI-111P network printer card. For details, refer to the upgrade procedure for the network card and network printer card.

CAUTION

- **The network must be managed by the network administrator. Make sure that each monitor in the network has a different IP address. Otherwise, data communication cannot be performed properly. When adding a unit to an already operating network, set the IP address on the monitor before connecting the monitor to the network.**
- **When the monitor is connected to a central monitor network, set the Bed Name (Bed ID) and Group Name on the monitor. Otherwise, the default settings are used for the bed name and group name and the bed may be incorrectly identified on the central monitor.**

NOTE

To change the settings, the network card and network printer card must be installed in the monitor.



*** NETWORK SETUP ***

EJECT CARD AND INSTALL AGAIN

DEFAULT GATEWAY 000 . 000 . 000 . 000

MANUAL IP ADDRESS 000 . 000 . 000 . 000

MANUAL SUBNET MASK 000 . 000 . 000 . 000

REFERENCE
AUTO IP ADDRESS 000 . 000 . 000 . 000
AUTO SUBNET MASK 255 . 000 . 000 . 000
MAC ADDRESS XX : XX : XX : XX : XX : XX

GROUP

Assign a group name for the bedside monitor. When the monitor has acquired the information of the network to which it is connected, the group names assigned by the central monitor appear. Select the group name from this list for the bedside monitor. For details, refer to the central monitor operator's manual.

DEFAULT GATEWAY: 0.0.0.0 to 255.255.255.255

Set the IP address of the default gateway when it exists in the network.

IP ADDRESS SETUP: AUTO, MANUAL

When set to AUTO, the IP address and subnet mask are set automatically.

MANUAL IP ADDRESS: 0.0.0.0 to 255.255.255.255

When IP ADDRESS SETUP is set to MANUAL, set the IP address of the bedside monitor manually.

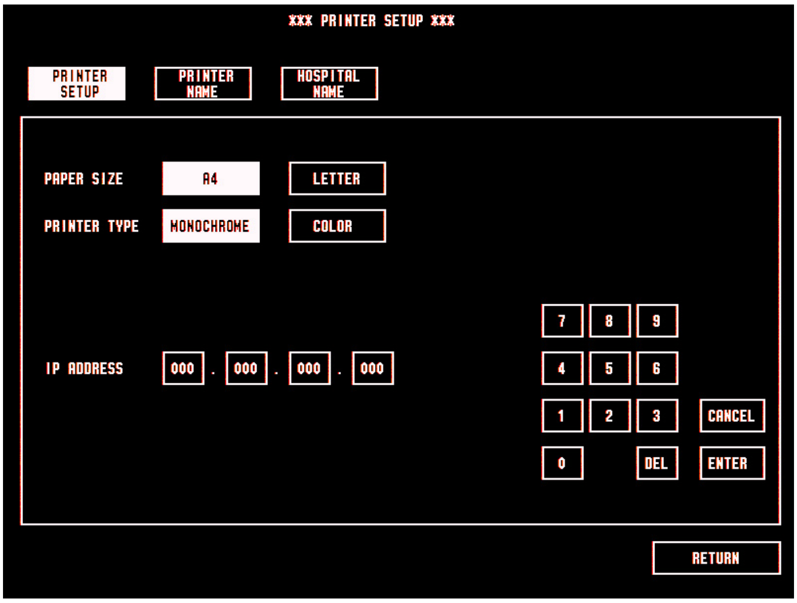
MANUAL SUBNET MASK: 0.0.0.0 to 255.255.255.255

When IP ADDRESS SETUP is set to MANUAL, set the subnet mask of the bedside monitor manually.

Network Printer Settings (PRINTER SETUP)

Change the network printer settings when using the optional QI-111P network printer card. For details, contact your Nihon Kohden distributor.

PRINTER SETUP



PAPER SIZE A4

PRINTER TYPE MONOCHROME

IP ADDRESS 000 . 000 . 000 . 000

PAPER SIZE: A4, LETTER

Select the size of the paper used on the network printer.

PRINTER TYPE: MONOCHROME, COLOR

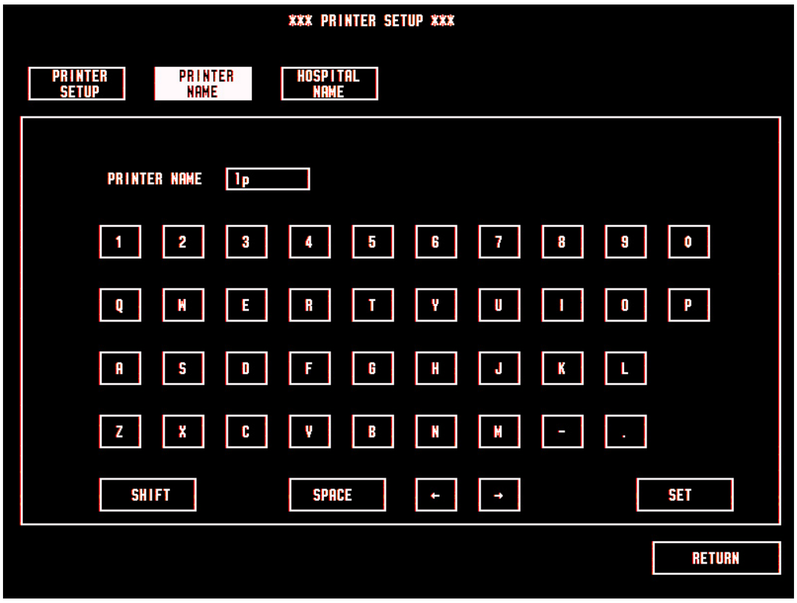
Select the color mode of the network printer.

IP ADDRESS: 0.0.0.0 to 255.255.255.255

Set the IP address of the network printer.

PRINTER NAME

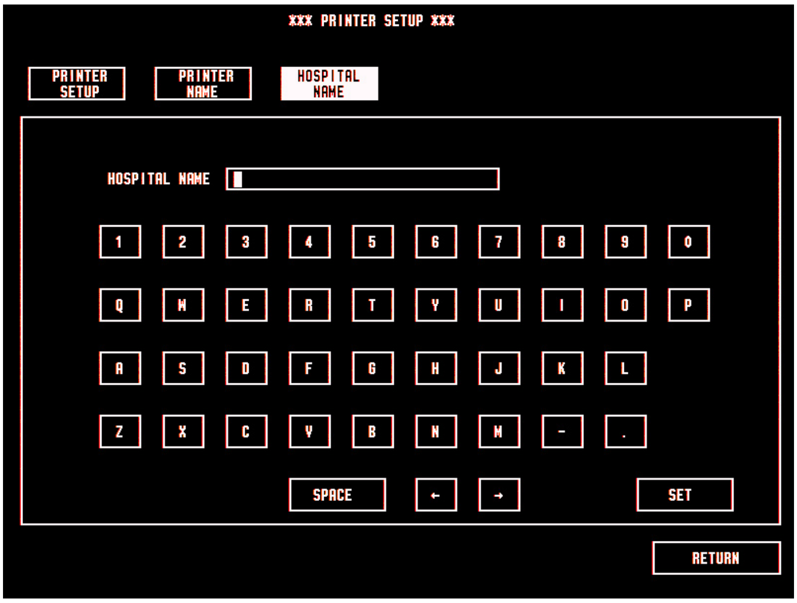
Enter the printer name. Normally, use the default setting “lp”. If data cannot be printed, change the setting to the printer name specified in the printer manual. If the printing still cannot be performed, contact your Nihon Kohden distributor.

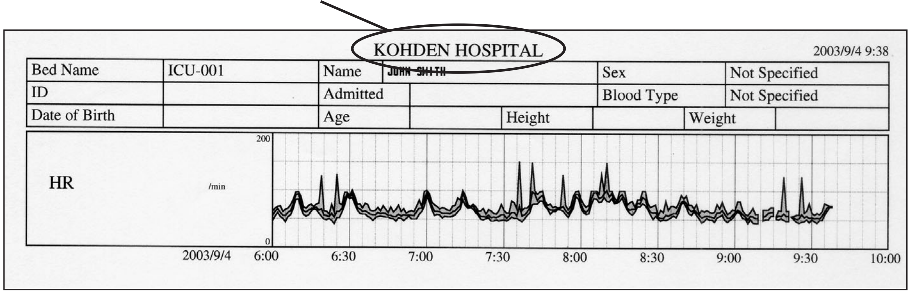

XXX PRINTER SETUP XXX
PRINTER SETUP
PRINTER NAME
HOSPITAL NAME
1 2 3 4 5 6 7 8 9 0
Q W E R T Y U I O P
A S D F G H J K L
Z X C V B N M - .
SHIFT
SPACE
←
→
SET
RETURN

PRINTER NAME lp

HOSPITAL NAME

You can print the hospital or institution name at the top of the printing paper. Up to 32 alphanumerics can be entered.


XXX PRINTER SETUP XXX
PRINTER SETUP
PRINTER NAME
HOSPITAL NAME
HOSPITAL NAME
1 2 3 4 5 6 7 8 9 0
Q W E R T Y U I O P
A S D F G H J K L
Z X C V B N M - .
SPACE
←
→
SET
RETURN



hospital or institution name

KOHDEN HOSPITAL

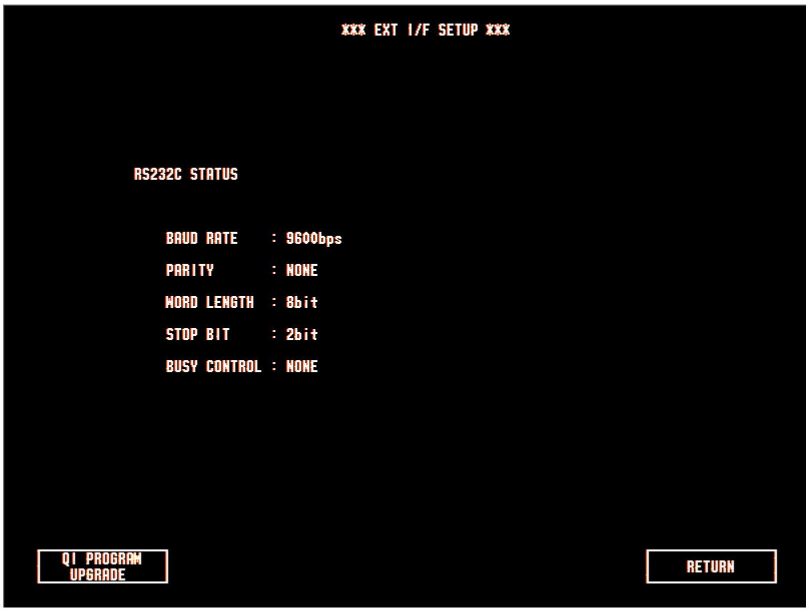
2003/9/4 9:38

Bed Name	ICU-001	Name	JOHN SMITH	Sex	Not Specified
ID		Admitted		Blood Type	Not Specified
Date of Birth		Age		Height Weight	

HR
/min
200
0
2003/9/4
6:00
6:30
7:00
7:30
8:00
8:30
9:00
9:30
10:00

External Interface Information (EXT I/F SETUP)

This screen is not used.



*** EXT I/F SETUP ***

RS232C STATUS

BAUD RATE : 9600bps
PARITY : NONE
WORD LENGTH : 8bit
STOP BIT : 2bit
BUSY CONTROL : NONE

QI PROGRAM UPGRADE
RETURN

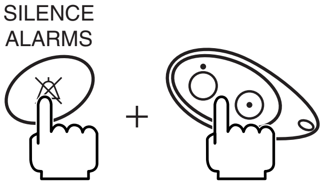
Initializing the System

Usually, this procedure is not performed. Use the following procedure to initialize the instrument. Initializing the instrument sets all settings to the factory default settings for ICU mode. The factory default settings are listed in “Factory Default Settings” in Section 19.

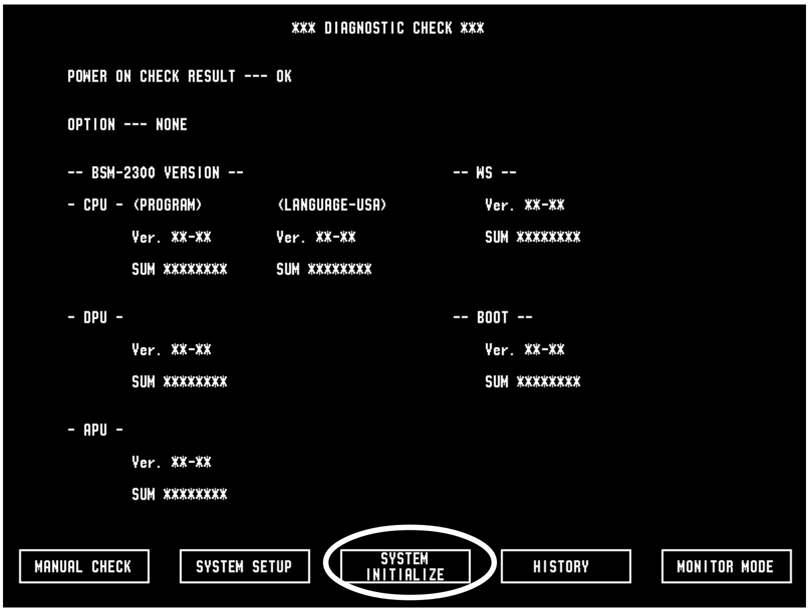
CAUTION

All patient data, stored data and error history are deleted and all settings return to the factory default settings.

1. If turned on, turn off the monitor power.



2. Press the power switch while pressing the SILENCE ALARMS key on the front panel until the DIAGNOSTIC CHECK screen is displayed.



```
                        *** DIAGNOSTIC CHECK ***

POWER ON CHECK RESULT --- OK

OPTION --- NONE

-- BSM-2300 VERSION --                          -- WS --
- CPU - (PROGRAM)        (LANGUAGE-USA)             Ver. **-**
        Ver. **-**       Ver. **-**                 SUM ********
        SUM ********     SUM ********

- DPU -                                         -- BOOT --
        Ver. **-**                                  Ver. **-**
        SUM ********                                SUM ********

- APU -
        Ver. **-**
        SUM ********
```

3. Touch and hold the “SYSTEM INITIALIZE” key for 3 seconds until the “PUSH 3 SECONDS” message disappears from the screen.

   When initializing starts, the “SYSTEM INITIALIZE” message appears on the screen and blinks for several seconds.

   When initializing is finished, the message disappears and the DIAGNOSTIC CHECK screen appears.

4. Touch the “MONITOR MODE” key on the DIAGNOSTIC CHECK screen to display the monitoring screen.

Section 4 Necessary Settings Before Monitoring

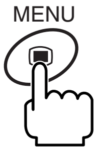
Changing Date and Time 4.1
Changing Sound Settings 4.3
Changing the Screen Brightness 4.5
Assigning a Function to the Function Keys 4.6
Entering Patient Name 4.8
    Displaying the PATIENT INFO Window 4.9
    Entering the Patient Name Using the Keyboard 4.10
    Entering the Patient Name Using Free Function 4.11
    Entering the Patient ID 4.12
Deleting Data 4.13

Changing Date and Time

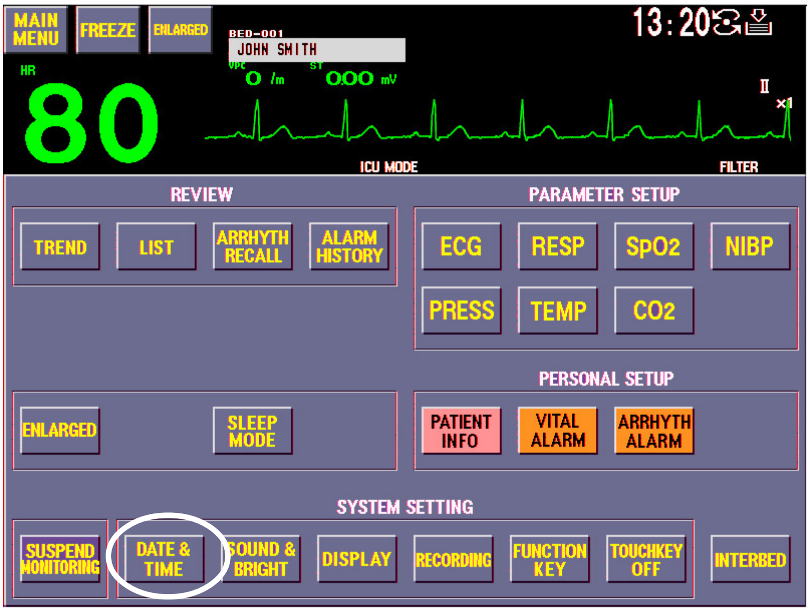
When the monitor power is on, the current time is displayed in the upper right corner of the screen.

NOTE

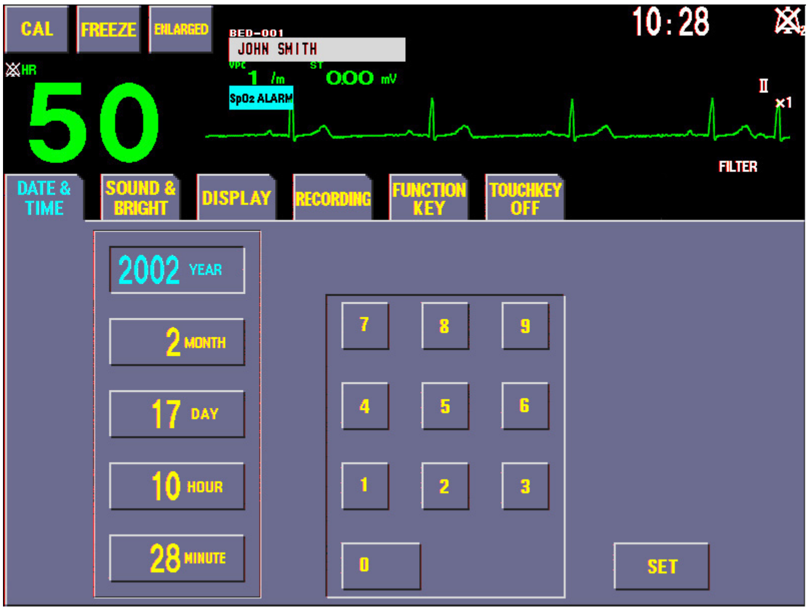
When the date or time is changed during monitoring, the date and time of all stored data is also changed and may not match the date and time on the printout.



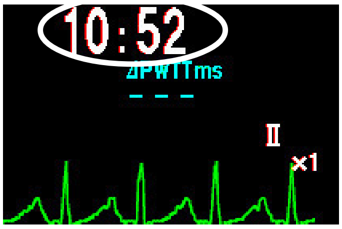
1. Press the MENU key on the front panel to display the MENU window.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC 0 /m
ST 0.00 mV
II
×1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

2. Touch the “DATE & TIME” key to display the DATE & TIME window.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
10:28
HR
50
VPC 1 /m
ST 0.00 mV
SpO2 ALARM
II
×1
FILTER
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
7
8
9
4
5
6
1
2
3
0
SET

2002 YEAR
2 MONTH
17 DAY
10 HOUR
28 MINUTE



The DATE & TIME window can also be displayed by touching the time on the upper right corner of the monitoring screen.

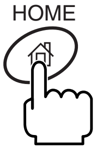
3. Touch the "YEAR", "MONTH", "DAY", "HOUR" or "MINUTE" key.

4. Touch the desired number(s).

5. Repeat steps 3 and 4 to enter other items.

6. Touch the "SET" key. The "SET" key must be touched before changing windows. Otherwise the setting changes back to the previous setting.

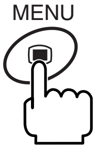
   When the set date is incorrect, the "OUT OF RANGE" message appears on the screen. Enter the correct date.



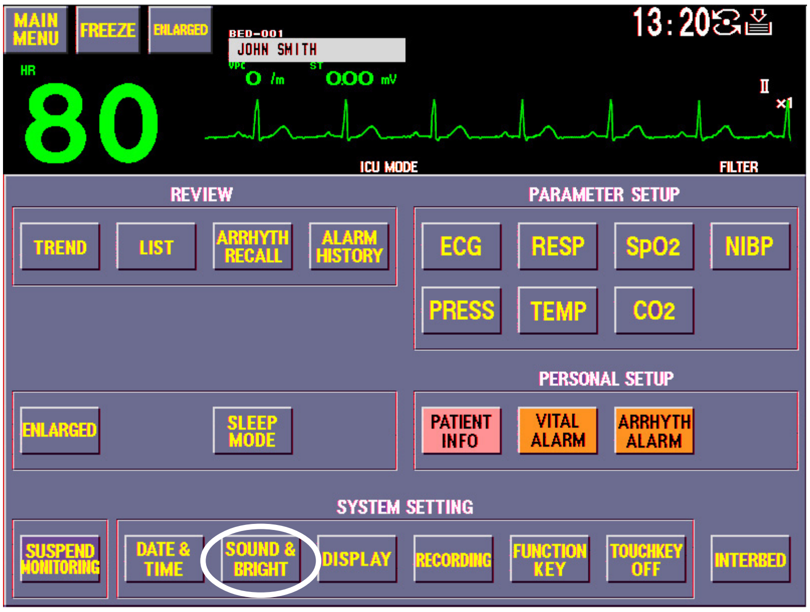
7. Press the HOME key on the front panel to return to the monitoring screen.

Changing Sound Settings

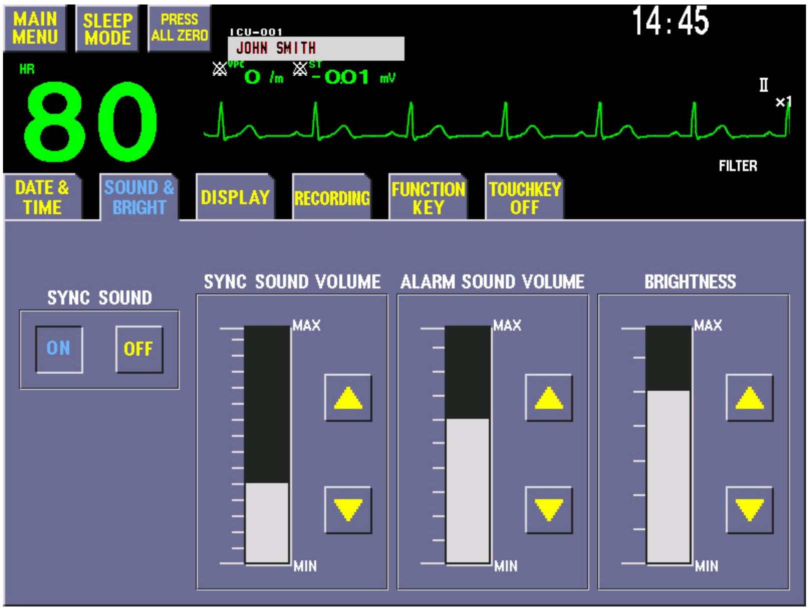
On the SOUND & BRIGHT window, you can select sync sound on or off and adjust the sync sound volume and alarm sound volume.



1. Press the MENU key on the front panel to display the MENU window.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC 0 /m
ST 0.00 mV
II
×1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

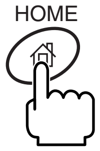
2. Touch the “SOUND & BRIGHT” key to display the SOUND & BRIGHT window.


MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
14:45
HR
80
VPC 0 /m
ST -0.01 mV
II
×1
FILTER
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
SYNC SOUND
ON
OFF
SYNC SOUND VOLUME
ALARM SOUND VOLUME
BRIGHTNESS
MAX
MIN
MAX
MIN
MAX
MIN

3. Select “ON” or “OFF” in the SYNC SOUND box to set sync sound on or off.

To change the synchronous sound volume, touch the desired place on the volume bar at SYNC SOUND VOLUME. Touch the ▲ or ▼ key to adjust the setting. At the lowest volume setting, the sync sound is not audible.

To change the alarm sound volume, touch the desired place on the volume bar at ALARM SOUND VOLUME. Touch the ▲ or ▼ key to adjust the setting. At the lowest volume setting, the alarm is still audible.

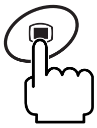


4. After changing settings, press the HOME key on the front panel to return to the monitoring screen.

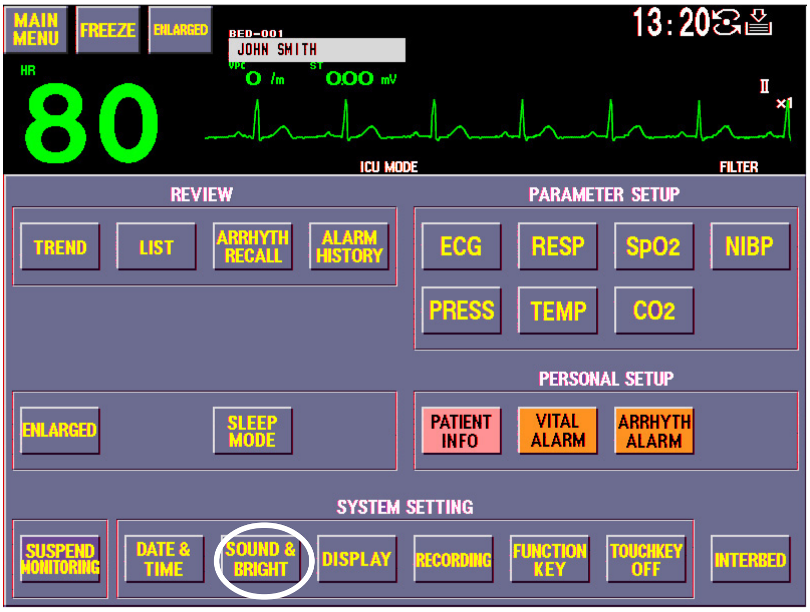
Changing the Screen Brightness

When operating on battery power, the brightness is automatically set to minimum.

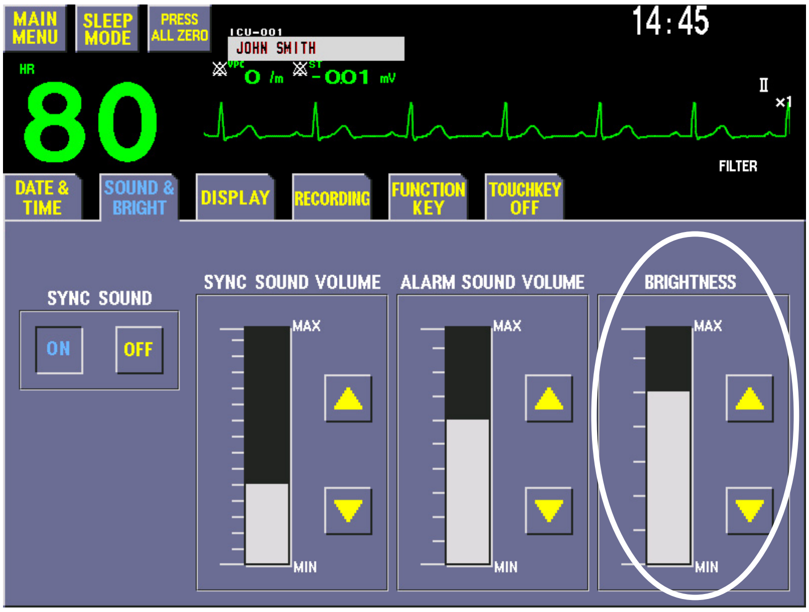
MENU



1. Press the MENU key on the front panel to display the MENU window.

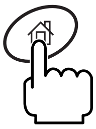

MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC
0 /m
ST
0.00 mV
II
×1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

2. Touch the “SOUND & BRIGHT” key to display the SOUND & BRIGHT window.


MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
14:45
HR
80
VPC
0 /m
ST
-0.01 mV
II
×1
FILTER
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
SYNC SOUND
ON
OFF
SYNC SOUND VOLUME
MAX
MIN
ALARM SOUND VOLUME
MAX
MIN
BRIGHTNESS
MAX
MIN

3. Touch the desired place on the setting bar in the BRIGHTNESS box. Use the ▲ or ▼ key to adjust the setting.

HOME



4. Press the HOME key on the front panel to return to the monitoring screen.

Assigning a Function to the Function Keys

A function or window can be assigned to each function key on the upper left corner of the screen for changing screens and often used function. When a function is assigned to the function key, that function can be performed or a window can be displayed by just touching the function key at the upper left corner of the screen instead of returning to the monitoring screen or displaying the MENU window. There are three function keys. One of the following functions or windows can be assigned to each key.

- FREEZE
- PRESS ALL ZERO
- PRINT
- BYPASS
- HOME
- DELETE ALL
- PWTT RECORD
- TREND
- ARRHYTH RECALL
- INTERBED
- TOUCHKEY OFF
- CAL
- SUSPEND MONITORING
- MAIN MENU
- SLEEP MODE
- OCRG RECORD
- ENLARGED
- LIST
- ALARM HISTORY

It may be useful to assign FREEZE, CAL and PRINT to the function keys, because there is no other FREEZE, CAL or PRINT key on any other screen. For the other functions and windows, you can always display these keys on the MENU window.

The BYPASS function key is only available when the site is set to OR and BYPASS is selected for ALARMS OFF TYPE on the SYSTEM SETUP screen.

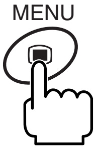
The SUSPEND MONITORING function key is only available when the site is set to either ICU or NICU and SUSPEND MONITORING is selected for ALARMS OFF TYPE on the SYSTEM SETUP screen.

The SLEEP MODE function key is only available when the site is set to either ICU or NICU on the SYSTEM SETUP screen.

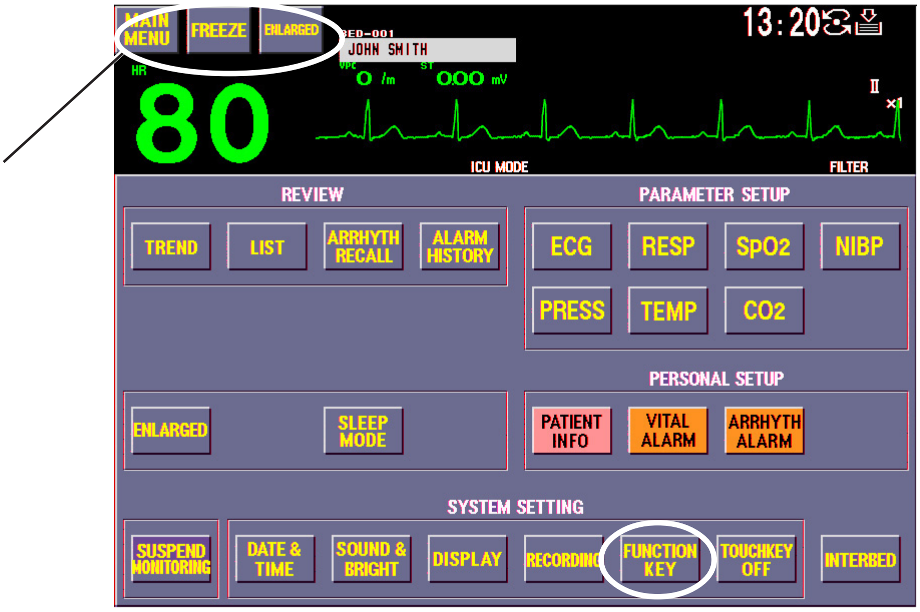
Touching the DELETE ALL function key opens the PATIENT INFO window.

The PRINT key is only available when the optional QI-111P printer card is inserted into the monitor.

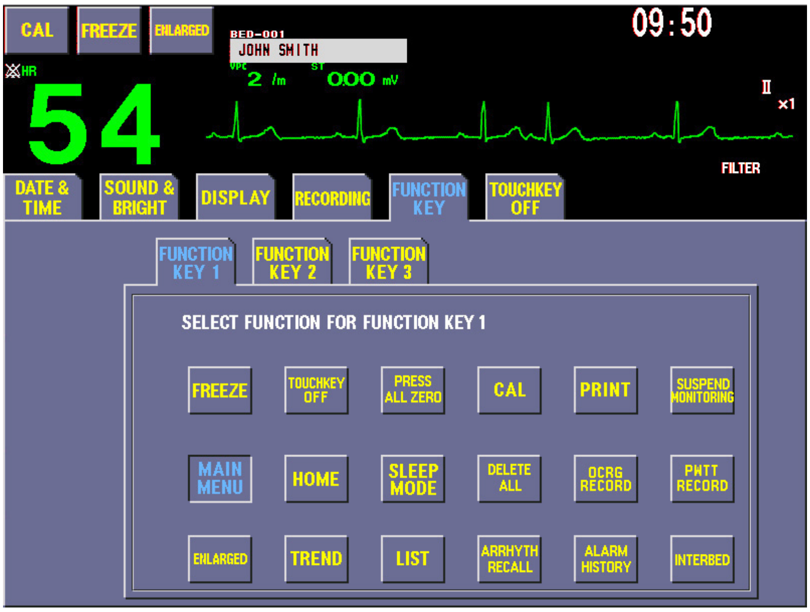
The OCRG RECORD and PWTT RECORD keys are only available when the optional WS-231P recorder module is installed in the monitor.



1. Press the MENU key on the front panel to display the MENU window.


Function keys
MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC
0 /m
ST
0.00 mV
II
×1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

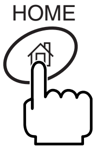
2. Touch the “FUNCTION KEY” key to display the FUNCTION KEY window.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
09:50
HR
54
VPC
2 /m
ST
0.00 mV
II
×1
FILTER
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
FUNCTION KEY 1
FUNCTION KEY 2
FUNCTION KEY 3
SELECT FUNCTION FOR FUNCTION KEY 1
FREEZE
TOUCHKEY OFF
PRESS ALL ZERO
CAL
PRINT
SUSPEND MONITORING
MAIN MENU
HOME
SLEEP MODE
DELETE ALL
OCRG RECORD
PNTT RECORD
ENLARGED
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
INTERBED

3. Touch the “FUNCTION KEY 1”, “FUNCTION KEY 2” or “FUNCTION KEY 3” tab to select the function key to which you want to assign a function.

4. Select the function you want to assign to the function key.

5. Repeat steps 3 and 4 to assign a function to another function key.



6. Press the HOME key on the front panel to return to the monitoring screen.

Entering Patient Name

Before entering data for a new patient, you must first delete all the data of a previous patient. Refer to the "Deleting Data" section.

WARNING

When admitting a new patient, check the alarm settings. The alarm settings return to the alarm master settings on the SYSTEM SETUP screen when all data is deleted on the DELETE ALL window or 30 minutes elapse after monitor power off.

CAUTION

When admitting a new patient, first delete all data of the previous patient. Otherwise, the data of the previous patient and new patient will be mixed together. To delete the previous patient data, refer to the "Deleting Data" section.

NOTE

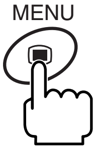
After turning the monitor on and when admitting a patient on the monitor, make sure that the time displayed at the upper right of the screen is correct. When the date or time is changed during monitoring, the date and time of all stored data is also changed and may not match the date and time on the printout.

There are two ways to enter the patient name. You can use both ways together.

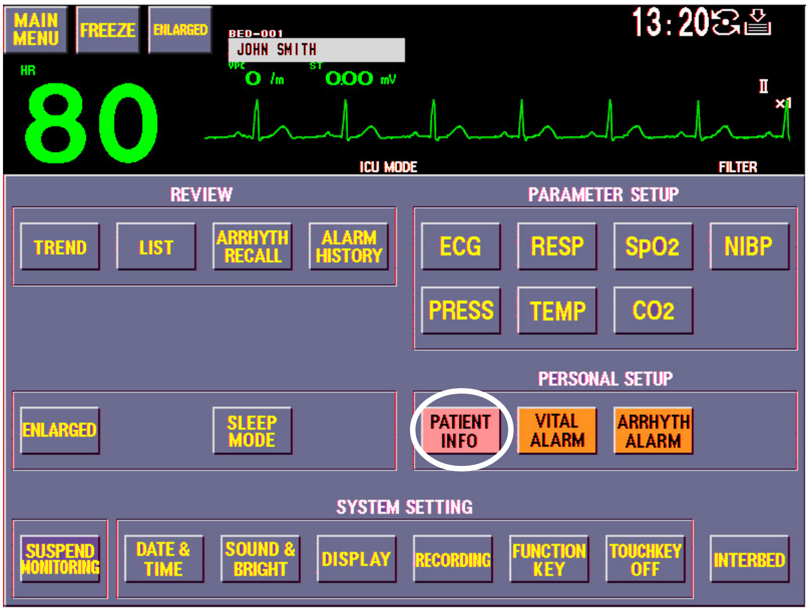
KEYBOARD:	Use the keyboard keys displayed on the window. Up to 20 alphanumeric characters can be entered.
FREE:	Any character or image you have drawn on the free writing area appears as the patient name.

When the monitor is connected to a monitor network with an optional QI-101P network card, the FREE window is not available. When the patient name is entered from the FREE window and the monitor is then connected to a network, the patient name on the bedside monitor is deleted and the patient name entered on the central monitor appears on the bedside monitor.

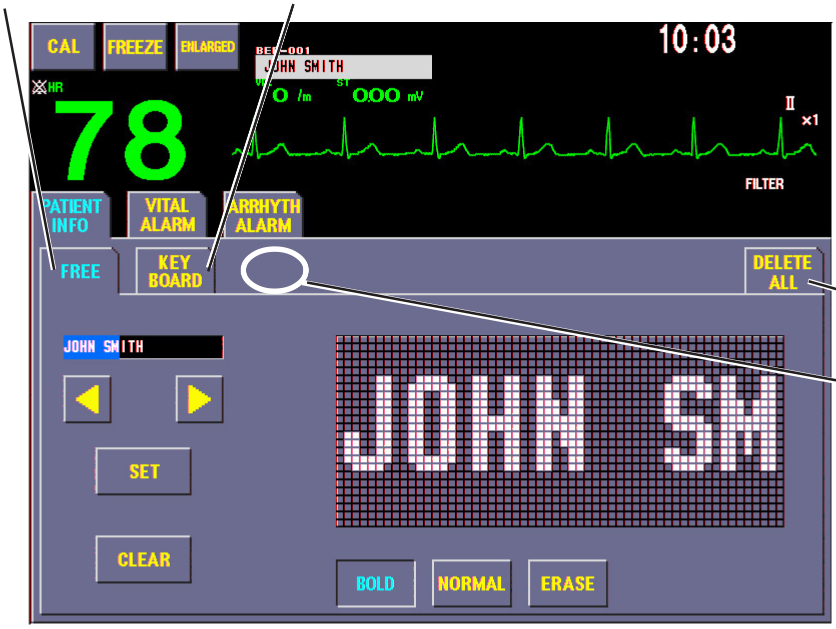
Displaying the PATIENT INFO Window



1. Press the MENU key on the front panel to display the MENU window.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC
O /m
ST
0.00 mV
II
×1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

2. Touch the “PATIENT INFO” key to display the PATIENT INFO window.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
10:03
HR
78
VPC
O /m
ST
0.00 mV
II
×1
FILTER
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
FREE
KEY BOARD
DELETE ALL
JOHN SMITH
SET
CLEAR
JOHN SM
BOLD
NORMAL
ERASE

Displays the FREE window

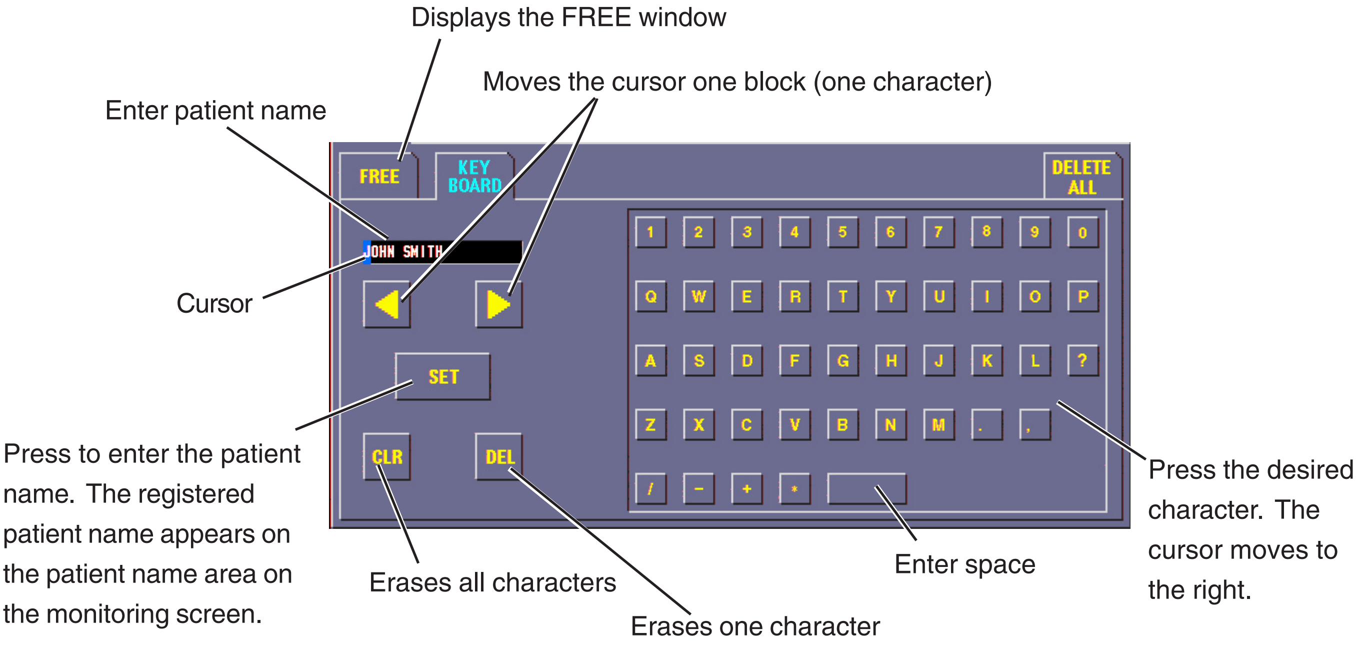
Displays the KEYBOARD window

For deleting data

When the optional QI-101P network card or QI-111P network printer card is connected to the monitor, the PATIENT ID tab appears.

Entering the Patient Name Using the Keyboard

1. Touch the “KEYBOARD” tab. The KEYBOARD window appears.


Displays the FREE window
Moves the cursor one block (one character)
Enter patient name
Cursor
FREE
KEY BOARD
DELETE ALL
JOHN SMITH
SET
CLR
DEL
1 2 3 4 5 6 7 8 9 0
Q W E R T Y U I O P
A S D F G H J K L ?
Z X C V B N M . ,
/ – + *
Press to enter the patient name. The registered patient name appears on the patient name area on the monitoring screen.
Erases all characters
Erases one character
Enter space
Press the desired character. The cursor moves to the right.

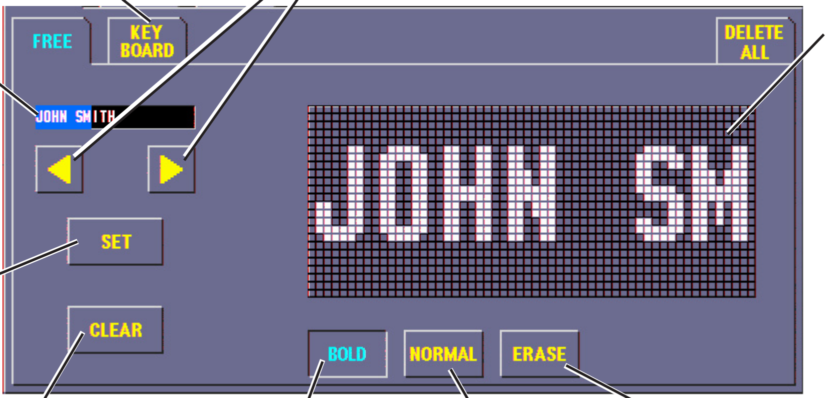
2. Enter the patient name by using the keyboard keys.

3. Touch the “SET” key. The patient name appears in the patient name area on the monitoring screen. If the window is changed before touching the “SET” key, the patient name is not registered.

Entering the Patient Name Using Free Function

1. Touch the "FREE" tab. The free writing area appears.

2. Write the patient name with your finger or touch pen (option) in the free writing area.


FREE
KEY BOARD
DELETE ALL
JOHN SMITH
SET
CLEAR
JOHN SM
BOLD
NORMAL
ERASE

Scrolls the writing area left or right. The displayed writing area is 1/4 of the total available writing area.

Displays the keyboard

Patient name

Writing area. Touch with your finger or touch pen to write the patient name. Your writing appears in the patient name box.

Press to enter the patient name. The registered patient name appears on the patient name area on the monitoring screen.

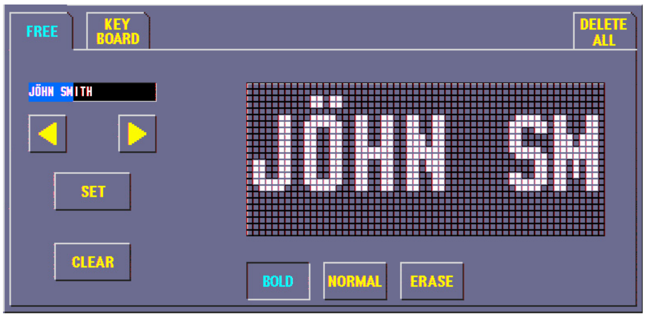
Erases all writing on the entire writing area

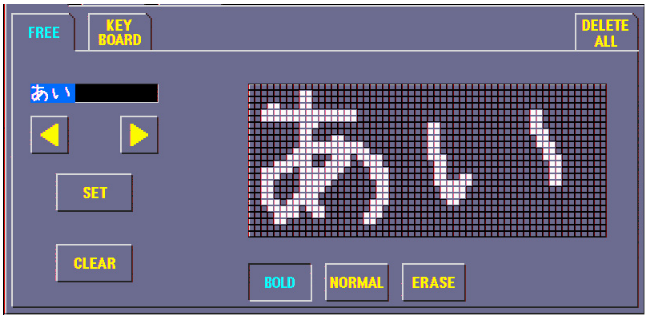
Sets the touch pen or finger to fill in a four block square

Sets the touch pen or finger to fill in one block

Sets the touch pen or finger to erase instead of write

You can enter any character by drawing it. You can also edit names which were previously entered by keyboard. For example, you can easily make European language characters from English characters.

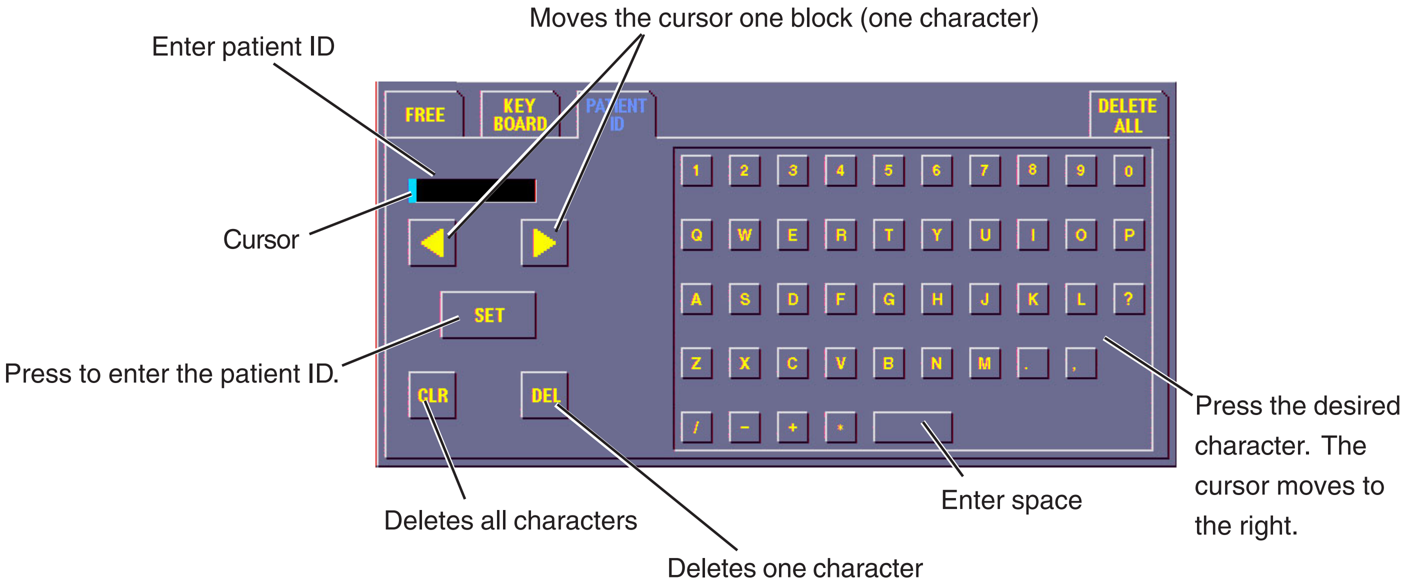

FREE
KEY BOARD
DELETE ALL
JÖHN SMITH
SET
CLEAR
JÖHN SM
BOLD
NORMAL
ERASE


FREE
KEY BOARD
DELETE ALL
あい
SET
CLEAR
あい
BOLD
NORMAL
ERASE

3. Touch the "SET" key. The patient name appears in the patient name area on the monitoring screen. If the window is changed before touching the "SET" key, the patient name is not registered.

Entering the Patient ID

When the QI-101P network card or QI-111P network printer card is connected to the monitor, you can enter a patient ID of up to 16 alphanumeric letters.


Moves the cursor one block (one character)
Enter patient ID
Cursor
Press to enter the patient ID.
FREE
KEY BOARD
PATIENT ID
DELETE ALL
SET
CLR
DEL
1 2 3 4 5 6 7 8 9 0
Q W E R T Y U I O P
A S D F G H J K L ?
Z X C V B N M . ,
/ – + *
Press the desired character. The cursor moves to the right.
Enter space
Deletes all characters
Deletes one character

1. Touch the “PATIENT ID” tab to display the PATIENT ID window.
2. Enter the patient ID by using the keyboard keys.
3. Touch the “SET” key.

Deleting Data

When monitoring the patient is no longer required, delete the data. The patient name and data on the review windows are deleted, the alarm settings return to the alarm master settings and NIBP measurement mode returns to the mode set at NIBP INTERVAL MASTER of PARAMETER SETUP.

CAUTION

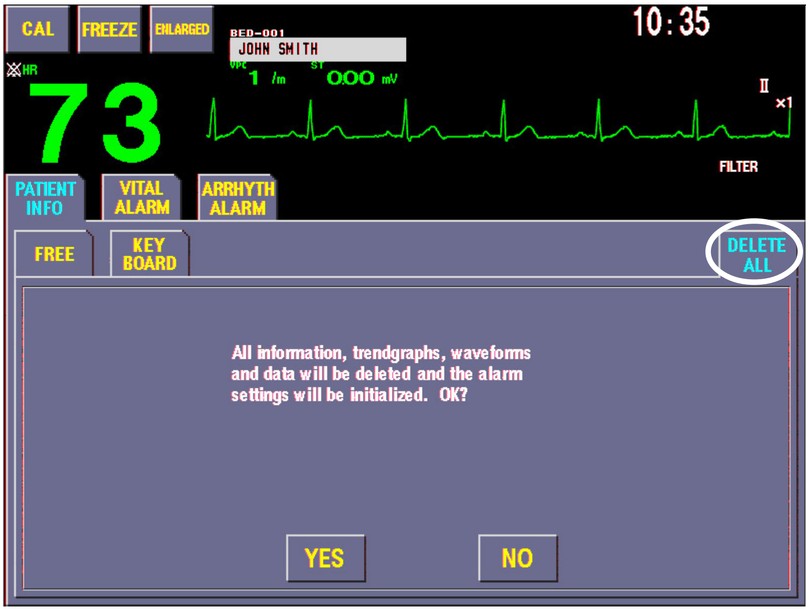
When admitting a new patient, first delete all data of the previous patient. Otherwise, the data of the previous patient and new patient will be mixed together.

You can select whether to enter standby mode on data deletion on SUSPEND MONITORING ON DATA DELETION on the SYSTEM SETUP screen. During standby mode, all alarms are suspended. Alarms resume when heart rate, SpO_2, IBP or $EtCO_2$ is monitored properly for the interval set for SUSPEND ALARM TIME on the SYSTEM SETUP screen or when NIBP is measured. Refer to Section 3.

When “DELETE ALL” is assigned to one of the function keys at the upper left of the screen, the DELETE ALL window of the PATIENT INFO window can be displayed by touching the “DELETE ALL” function key.

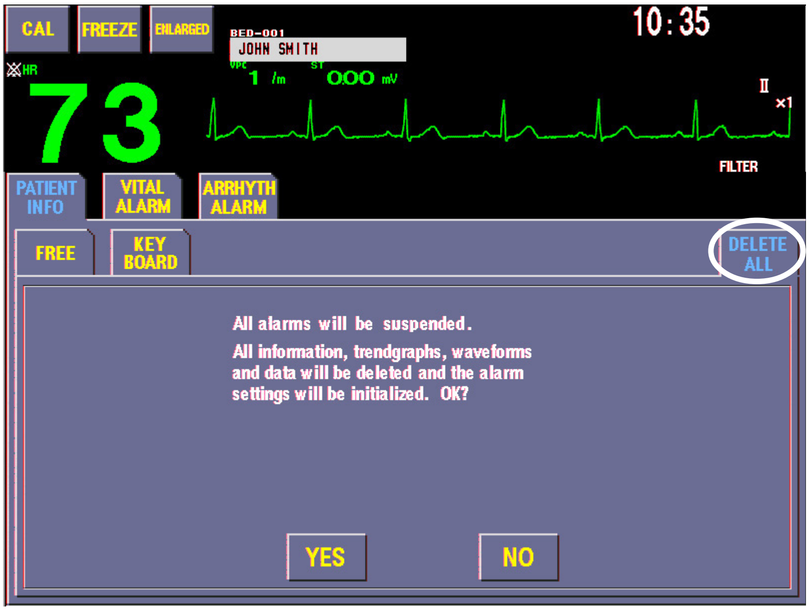
1. Display the PATIENT INFO window by following the procedure in the “Displaying the PATIENT INFO Window” section.

2. Touch the “DELETE ALL” tab. The message confirming the data deletion appears.



All information, trendgraphs, waveforms and data will be deleted and the alarm settings will be initialized. OK?

When SUSPEND MONITORING ON DATA DELETION on the SYSTEM SETUP screen is set to NO

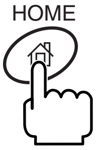

CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
HR
73
VPC
1 /m
ST
0.00 mV
10:35
II
×1
FILTER
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
FREE
KEY BOARD
DELETE ALL
YES
NO

All alarms will be suspended.

All information, trendgraphs, waveforms and data will be deleted and the alarm settings will be initialized. OK?

When SUSPEND MONITORING ON DATA DELETION on the SYSTEM SETUP screen is set to YES

3. Touch the “YES” key to delete data. The “Data deleted” message appears. Touch the “NO” key to not delete data.



4. Press the HOME key on the front panel to return to the monitoring screen.

Section 5 Monitoring Screen

Safety Precautions for Monitoring 5.2
        Using an Electrosurgery Unit 5.2
        Using a Defibrillator 5.2
Overview 5.3
    Monitoring Screen 5.3
    Review Windows 5.3
    Sync Sound 5.4
    Adjusting the Sync and Alarm Sound Volume 5.4
    Changing Settings and Performing Other Tasks During Monitoring 5.4
    Interbed Monitoring 5.4
Monitoring Screen 5.5
    Settings for the Monitoring Screen 5.6
        Waveform Sweep Mode and Speed 5.6
        Trendgraph/PWTT trendgraph/OCRG Display on the Monitoring Screen On or Off 5.6
        Background and Parameter Colors 5.7
        Waveform Sensitivity 5.7
    Displaying Other Windows from the Monitoring Screen 5.8
Changing Settings for Monitoring Screen 5.9
Displaying OCRG 5.11
Displaying PWTT Trendgraph 5.12
Freezing Waveforms 5.13
Using Sleep Mode 5.14
        Turning Sleep Mode On 5.14
        Turning Sleep Mode Off 5.15
Displaying the Large Numeric Window 5.16

This section explains how to monitor the patient’s waveforms and data.

Before monitoring the patient:

- Prepare the patient and equipment according to Sections 2 to 4, 6 and 10 to 16. When using a recorder module, also see Section 8.
- Before monitoring a new patient, follow the flowchart in Section 2.
- Read the safety precautions in the “Safety Precautions for Monitoring” section.

In this section:

- “Overview” gives general information for all monitoring.
- “Changing Settings for Monitoring Screen” explains about changing monitoring screen layout.
- “Freezing Waveforms” explains how to freeze waveforms.
- “Using Sleep Mode” explains how to use sleep mode.
- “Displaying Large Numeric Window” explains about displaying large numeric data.
- “Displaying OCRG” explains about displaying OCRG.
- “Displaying PWTT trendgraph” explains about displaying PWTT trendgraph.

Safety Precautions for Monitoring

Before beginning monitoring, observe the following safety precautions and the safety precautions in Sections 10 to 16 for ECG and other monitored parameters.

Using an Electrosurgery Unit

WARNING

- **Electrosurgical units (ESU) emit a lot of RF interference. If the monitor is used with an ESU, RF interference may affect the monitor operation.**
- **Locate the monitor as far as possible from the ESU. Locate them on opposite sides of the operating table, if possible.**
- **Connect the monitor and ESU to different AC outlets located as far as possible from each other.**
- **When using this monitor with an electrosurgical unit, its return plate and the electrodes for monitoring must be firmly attached to the patient. If the return plate is not attached correctly, it may burn the patient's skin where the electrodes are attached.**

Using a Defibrillator

WARNING

To avoid the risk of serious electrical burn, shock, or other injury during defibrillation, all persons must keep clear of the bed and must not touch the patient or any equipment connected to the patient.

If the ECG waveform on the screen is too unstable to synchronize with the patient's heart beat because of the following reason(s), remove the cause(s) of an alarm, message, or unstable ECG, and then use a stable ECG lead for synchronization.

- ECG electrode is detached or broken. Lead wire is detached or broken.
- Lead wire moves. AC interference, EMG noise or noise from ESU is superimposed.
- Connection cable is broken or has a short circuit. Connector has poor contact.

Overview

Monitoring Screen

When you first begin monitoring, a monitoring screen appears. The monitoring screen displays waveforms and numeric data for ECG and other parameters. Any time you press the HOME key on the front panel, the monitoring screen appears.

The parameters on the monitoring screen depend on the measured parameter.

When the monitor power is turned on, it enters “standby mode” while the monitor is waiting for the electrodes and probe to be attached to the patient. “CHECK ELECTRODES”, “CHECK PROBE”, “CANNOT DETECT PULSE” and “CHECK SENSOR” alarms will not be activated. “DETECTING PULSE” message will not be displayed. The ECG or SpO_2 monitoring starts when the connection cord is connected to the socket on the monitor and electrodes or probe is attached to the patient.

NOTE

If the monitor power is turned off and on again within 10 seconds, the monitor skips standby mode.

You can adjust the time width of the trendgraph on the monitoring screen with your finger by touching the position for the right edge of the trendgraph on the screen.

A PWTT trendgraph or an OCRG can be displayed on the monitoring screen instead of a trendgraph. Refer to the “Displaying PWTT Trendgraph” and “Displaying OCRG” section.

PWTT trendgraph is not available on the BSM-2304 bedside monitor.

Review Windows

NOTE

The stored data remains in memory for about 30 minutes after the monitor power is turned off. After 30 minutes, the stored data is lost.

The trend, list, arrhythmia recall and alarm history windows display the stored data. You can display a trendgraph of the past 1 to 24 hours on the trend window, the list of vital signs data on the list window, arrhythmia recall files of up to 16 files on the arrhythmia recall window and alarm data of up to 200 files on the alarm history window.

There are two types of lists for the list window: periodic vital signs list and NIBP list (vital signs list with NIBP measurements). Up to 120 measurements can be stored for each type.

For details about the review windows, refer to Section 7.

Sync Sound

During monitoring, a continuous “pip” sounds in synchronization with either the QRS or pulse waveform. QRS is the default setting. Refer to “Changing the Sync Source” in Section 10, 12 or 14 to change the source of the sync sound.

Adjusting the Sync and Alarm Sound Volume

The sync sound volume and alarm sound volume can be adjusted on the SOUND & BRIGHT window. At the lowest setting, the alarm sound is audible but the sync sound is not audible. Refer to “Changing Sound Settings” in Section 4.

Changing Settings and Performing Other Tasks During Monitoring

Every screen except the SYSTEM SETUP screen always displays at least one realtime ECG waveform and heart rate. This lets you monitor the patient continuously without interruption while you do other tasks, such as changing settings, printing reports, or viewing trendgraphs.

The screen returns to the monitoring screen when there is no key operation for about 3 minutes.

Site Mode

The site mode can be selected from OR, ICU and NICU according to the environment. The default settings, including alarm upper and lower limit settings, differ according to site. Refer to Section 3.

OR:	The “BYPASS” key is displayed on the MENU window. Sleep mode is not available.
ICU, NICU:	The “SUSPEND MONITORING” key is displayed on the MENU window. Sleep mode is available.

When “ALL ALARMS OFF” is selected for ALARMS OFF TYPE on the ALARM SETUP screen, the “ALL ALARMS OFF” key is displayed instead of the “BYPASS” or “SUSPEND MONITORING” key on the MENU window. Refer to “Alarm Settings” in Section 3.

For details on the functions of the “BYPASS”, “SUSPEND MONITORING” and “ALL ALARMS OFF” keys, refer to “Silencing and Suspending Alarms” in Section 6.

Interbed Monitoring

When the bedside monitor is connected to a central monitor, the bedside monitor data can be sent to the central monitor. Up to 8 beds in the network can be registered as “interbed” beds and monitoring data of the selected interbed bed can be displayed on the INTERBED window. When an alarm occurs at an interbed bed, the “ALARM bed name” message appears on this bedside monitor screen.

The interbed alarm can be silenced from this bedside monitor. The cause for the interbed bed can only be confirmed on the central monitor or the alarmed interbed bed.

To register the other beds as interbed beds, refer to “Registering Interbed Beds” in Section 9.

To connect the bedside monitor to the central monitor network, the optional QI-101P network card is required.

Monitoring Screen

When you first begin monitoring, a monitoring screen appears.

The monitoring screen is automatically laid out according to the measured parameters. The layout changes when a measuring parameter changes.

The settings for monitoring parameters can be changed individually on the parameter window. For details about individual parameters, see Sections 10 to 16.

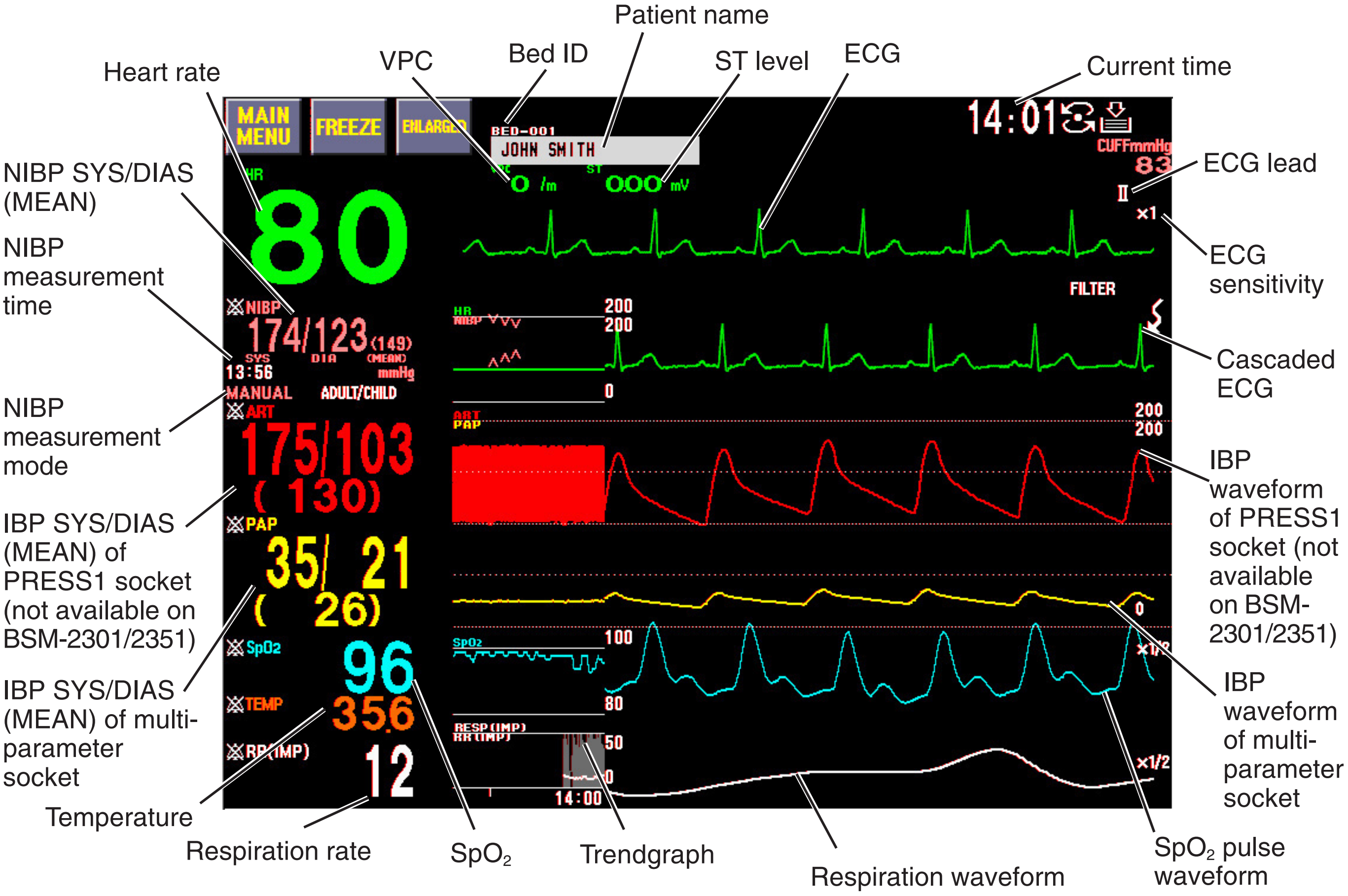
The respiration rate can only be detected from one parameter. When CO_2 and respiration are monitored at the same time, the respiration rate is detected in the following priority.
CO_2 > thermistor method respiration > impedance method respiration

The latest 30 minute parameter data can be displayed as a trendgraph on the monitoring screen. This trendgraph can be dragged by touching the position of the right edge of the trendgraph on the screen.

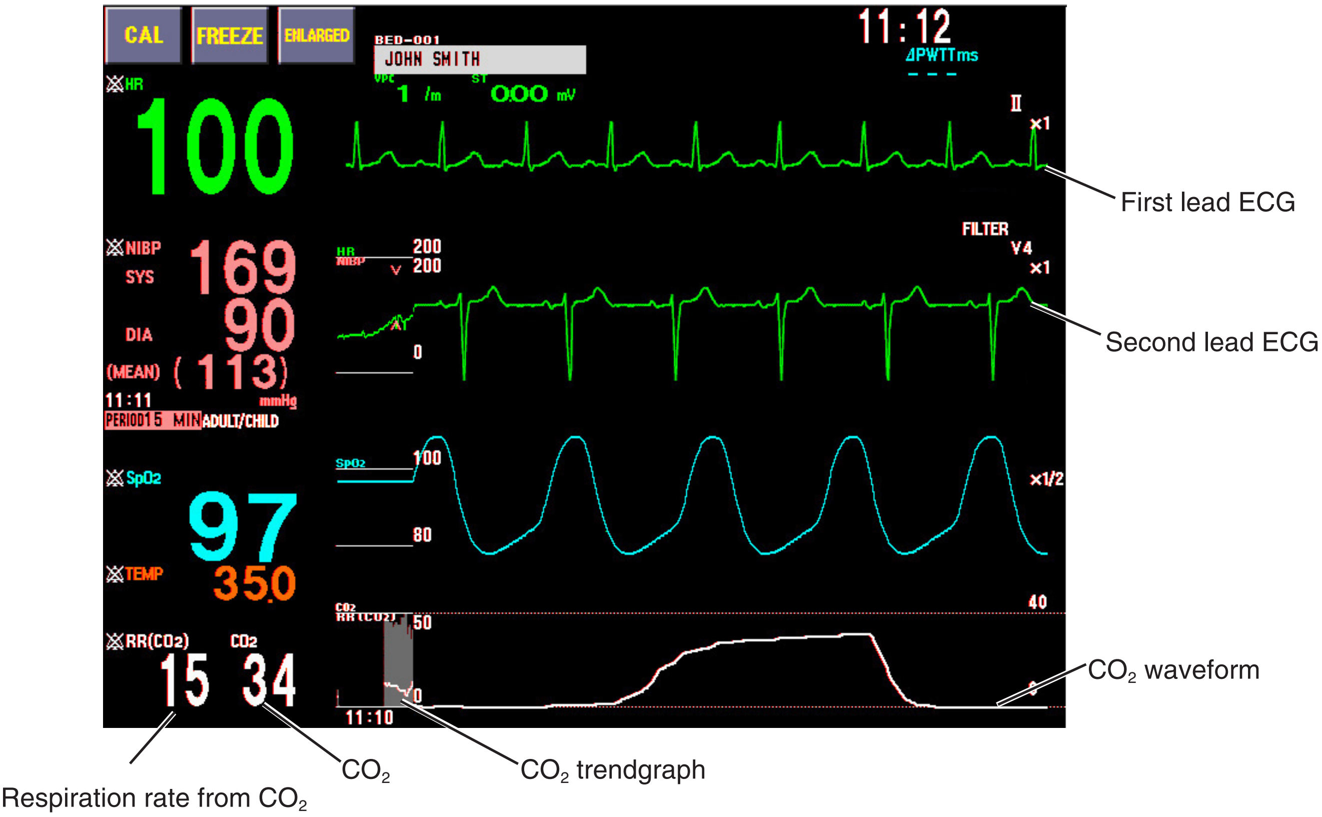
A PWTT trendgraph or an OCRG can be displayed on the monitoring screen instead of a trendgraph. Refer to the “Displaying PWTT Trendgraph” and “Displaying OCRG” section.

PWTT trendgraph is not available on the BSM-2304 bedside monitor.

When monitoring ECG with 3 electrodes, impedance respiration, SpO_2, NIBP, 2-channel IBP and temperature


Patient name
Heart rate
VPC
Bed ID
ST level
ECG
Current time
NIBP SYS/DIAS (MEAN)
NIBP measurement time
NIBP measurement mode
IBP SYS/DIAS (MEAN) of PRESS1 socket (not available on BSM-2301/2351)
IBP SYS/DIAS (MEAN) of multi-parameter socket
Temperature
Respiration rate
SpO₂
Trendgraph
Respiration waveform
SpO₂ pulse waveform
IBP waveform of multi-parameter socket
IBP waveform of PRESS1 socket (not available on BSM-2301/2351)
Cascaded ECG
ECG sensitivity
ECG lead
MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
HR
80
VPC
0 /m
ST
0.00 mV
14:01
CUFFmmHg
83
II
×1
FILTER
NIBP
174/123 (149)
SYS DIA (MEAN)
13:56
mmHg
MANUAL
ADULT/CHILD
ART
175/103
(130)
PAP
35/ 21
(26)
SpO2
96
TEMP
35.6
RR(IMP)
12
200
200
0
100
80
50
0
14:00
×1/2

When monitoring ECG with 6 electrodes, SpO_2, NIBP, temperature and CO_2


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
11:12
ΔPWTTms
VPC 1 /m
ST 0.00 mV
HR
100
II
×1
First lead ECG
NIBP
SYS 169
DIA 90
(MEAN) (113)
11:11
mmHg
PERIOD 15 MIN
ADULT/CHILD
HR
NIBP
200
200
0
FILTER
V4
×1
Second lead ECG
SpO2
100
80
×1/2
SpO2
97
TEMP
35.0
RR(CO2)
CO2
15
34
CO2
RR(CO2)
50
0
11:10
40
0
CO₂ waveform
Respiration rate from CO₂
CO₂
CO₂ trendgraph

Settings for the Monitoring Screen

Waveform Sweep Mode and Speed

The waveform sweep speed (25 or 50 mm/s) and display mode (fixed or moving) on the monitoring screen can be set on the SYSTEM SETUP screen. Refer to Section 3.

Sweep speed: SWEEP SPEED
Sweep mode: WAVE DISPLAY

The respiration and CO_2 waveform sweep speed on the monitoring screen can be selected from one of three speeds: 1, 6, or 25 or 50 mm/s at RESP SWEEP SPEED on the DISPLAY window, RESP window or CO_2 window. The third selectable speed in RESP SWEEP SPEED is the setting in SWEEP SPEED on the DISPLAY SETUP of the SYSTEM SETUP screen. (25 or 50 mm/s)

Trendgraph/PWTT trendgraph/OCRG Display on the Monitoring Screen On or Off

The trendgraph/PWTT trendgraph/OCRG display on the monitoring screen depends on the WAVE DISPLAY setting on the SYSTEM SETUP screen and TREND ON MONITORING SCREEN setting on the DISPLAY window. Refer to Section 3 and the “Changing Settings for Monitoring Screen” section, respectively.

WAVE DISPLAY setting

FIXED:	Trendgraph/PWTT trendgraph/OCRG is not displayed on the monitoring screen.
MOVING:	Trendgraph/PWTT trendgraph/OCRG is displayed on the monitoring screen.

TREND ON MONITORING SCREEN setting

NORMAL:	Trendgraph display on the monitoring screen
PWTT:	PWTT trendgraph display on the monitoring screen
OCRG 1 cm/min:	OCRG display with the horizontal scale 1 cm/min
OCRG 3 cm/min:	OCRG display with the horizontal scale 3 cm/min
OFF:	No trendgraph/PWTT trendgraph/OCRG display on the monitoring screen

Background and Parameter Colors

The background color of the monitoring screen can be set to either black or white on the BACKGROUND on the SYSTEM SETUP screen. Refer to Section 3.

The parameter colors are set on the PARAMETER COLOR on the SYSTEM SETUP screen. Refer to Section 3.

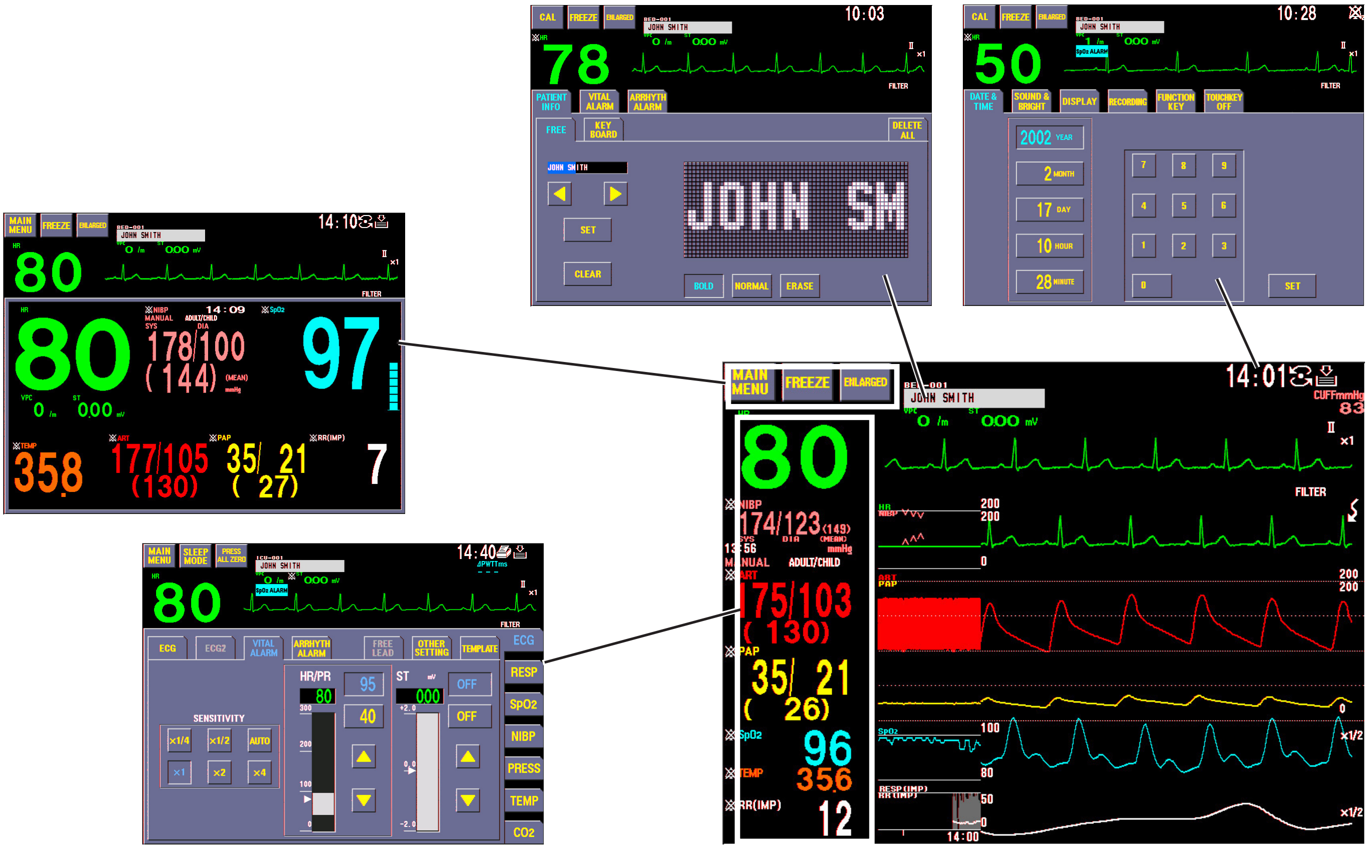
Waveform Sensitivity

Waveform sensitivity can be changed on the parameter window. Refer to Sections 10 to 16.

Displaying Other Windows from the Monitoring Screen

Touching the following items on the monitoring screen displays the following windows.

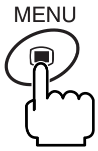
- Numeric value ..... Parameter setting window
- Patient name .... PATIENT INFO window
- Time .... DATE & TIME window
- Function key .... Window assigned to the function key


CAL
FREEZE
ENLARGED
10:03
JOHN SMITH
78
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
FREE
KEY BOARD
DELETE ALL
SET
CLEAR
BOLD
NORMAL
ERASE
10:28
50
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
2002 YEAR
2 MONTH
17 DAY
10 HOUR
28 MINUTE
MAIN MENU
14:10
80
178/100
(144)
97
358
177/105
(130)
35/ 21
(27)
7
14:40
SLEEP MODE
PRESS ALL ZERO
ECG
ECG2
VITAL ALARM
ARRHYTH ALARM
FREE LEAD
OTHER SETTING
TEMPLATE
SENSITIVITY
×1/4
×1/2
AUTO
×1
×2
×4
HR/PR
95
40
ST
OFF
RESP
SpO2
NIBP
PRESS
TEMP
CO2
14:01
174/123
175/103
(130)
35/ 21
(26)
96
356
12
FILTER

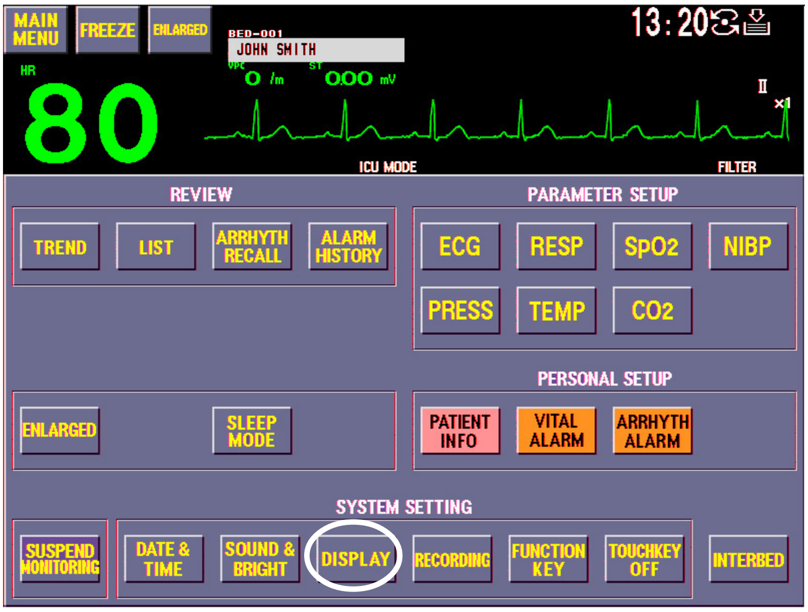
Changing Settings for Monitoring Screen

The trendgraph/PWTT trendgraph/OCRG display on or off and respiration/CO_2 waveform sweep speed can be set for the monitoring screen layout.

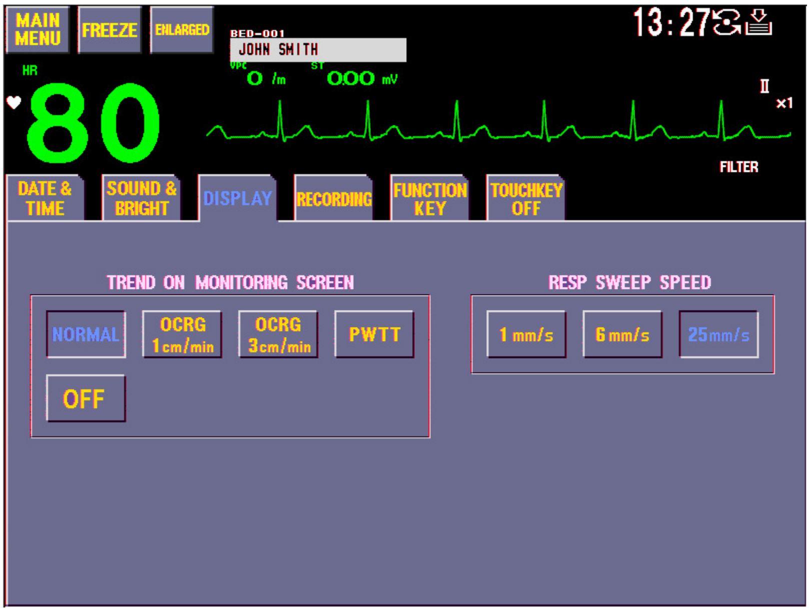
PWTT trendgraph is not available on the BSM-2304 bedside monitor.



1. Press the MENU key on the front panel. The MENU window appears.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC 0 /m
ST 0.00 mV
II
×1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
ENLARGED
SLEEP MODE
PERSONAL SETUP
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

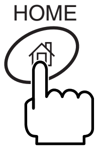
2. Touch the “DISPLAY” key on the MENU window to open the DISPLAY window.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:27
HR
80
VPC 0 /m
ST 0.00 mV
II
×1
FILTER
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
TREND ON MONITORING SCREEN
NORMAL
OCRG 1cm/min
OCRG 3cm/min
PWTT
OFF
RESP SWEEP SPEED
1 mm/s
6 mm/s
25mm/s

3. To change the trendgraph/PWTT trendgraph/OCRG display, select one of the following.

NORMAL:	Trendgraph display on the monitoring screen
PWTT:	PWTT trendgraph display on the monitoring screen
OCRG 1 cm/min:	OCRG display with the horizontal scale 1 cm/min
OCRG 3 cm/min:	OCRG display with the horizontal scale 3 cm/min
OFF:	No trendgraph/PWTT trendgraph/OCRG display on the monitoring screen

To change the respiration/CO_2 waveform sweep speed, select from one of three speeds: 1, 6, or 25 or 50 mm/s in the RESP SWEEP SPEED box. The third selectable speed in RESP SWEEP SPEED is the setting in SWEEP SPEED on the DISPLAY SETUP of the SYSTEM SETUP screen. (25 or 50 mm/s)



4. Press the HOME key on the front panel to return to the monitoring screen.

Displaying OCRG

The OCRG (oxygen-cardio-respirogram) can be displayed on the monitoring screen instead of a trendgraph.

On the OCRG, only HR and SpO_2 trendgraphs and compressed respiration waveform are displayed. When other parameter is monitored, only the numeric data and waveform for that parameter are displayed on the monitoring screen.

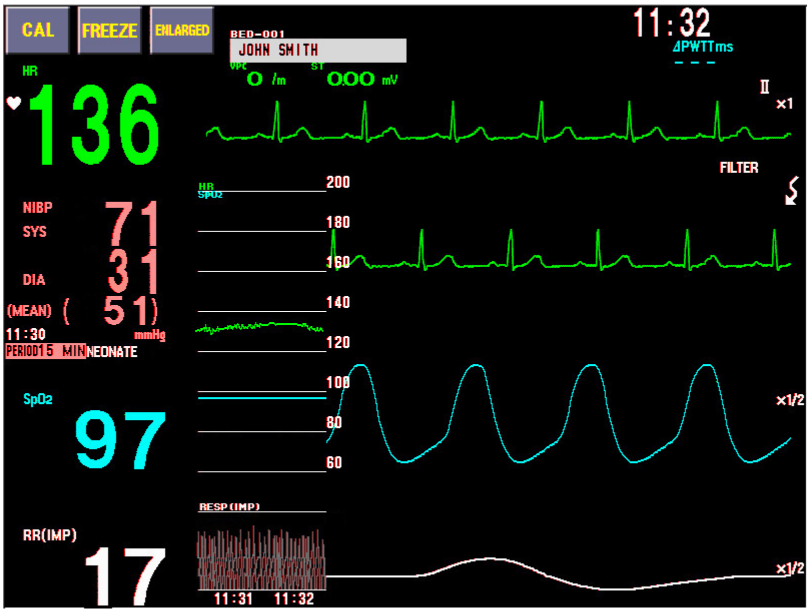
To display OCRG on the monitoring screen, set TREND ON MONITORING SCREEN to either OCRG 1 cm/min or OCRG 3 cm/min on the DISPLAY window. Refer to the “Changing Settings for Monitoring Screen” section.

To record OCRG,

- Set PERIODIC REC INTERVAL (min) on the RECORDING window to 5(OCRG) or 15(OCRG). Refer to “Setting Periodic Recording” in Section 8.

Or,

- Assign OCRG RECORD to one of the function keys. Refer to “Assigning Functions to Function Keys” in Section 4.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
11:32
ΔPWTTms
VPC
0 /m
ST
0.00 mV
HR
136
II
×1
FILTER
HR
SpO2
200
180
160
140
120
100
80
60
NIBP
SYS
71
DIA
31
(MEAN) (51)
11:30
mmHg
PERIOD15 MIN
NEONATE
SpO2
97
×1/2
RESP(IMP)
RR(IMP)
17
11:31
11:32
×1/2

Displaying PWTT Trendgraph

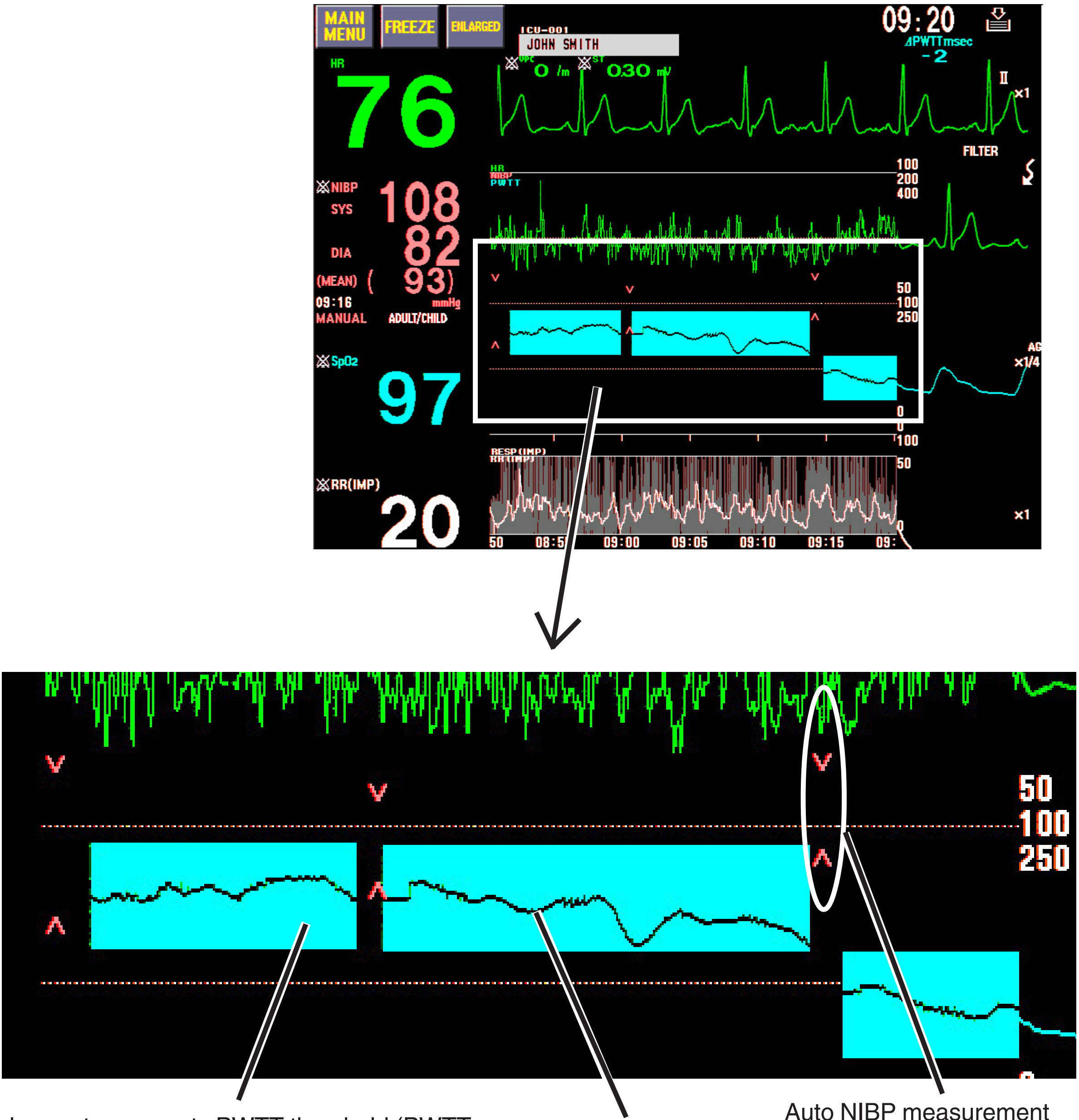
PWTT trendgraph is not available on the BSM-2304 bedside monitor.

The PWTT trendgraph can be displayed on the monitoring screen instead of a trendgraph.

On the PWTT trendgraph, trendgraph of HR, NIBP, RESP and RR are displayed together with PWTT trendgraph.

To display PWTT trendgraph on the monitoring screen, set TREND DISPLAY ON MONITORING SCREEN to PWTT on the DISPLAY window. Refer to the "Changing Settings for Monitoring Screen" section.

For the details of PWTT measurement, refer to Section 13.


MAIN MENU
FREEZE
ENLARGED
ICU-001
JOHN SMITH
09:20
ΔPWTTmsec
-2
HR
76
VPC 0 /m
ST 0.30 mV
II
×1
FILTER
NIBP
SYS
108
DIA
82
(MEAN) (93)
mmHg
09:16
MANUAL
ADULT/CHILD
HR
NIBP
PWTT
100
200
400
50
100
250
SpO2
97
AG
×1/4
0
100
RESP(IMP)
RR(IMP)
50
RR(IMP)
20
×1
50 08:5 09:00 09:05 09:10 09:15 09:

The blue part represents PWTT threshold (PWTT trigger time set on the PWTT window).

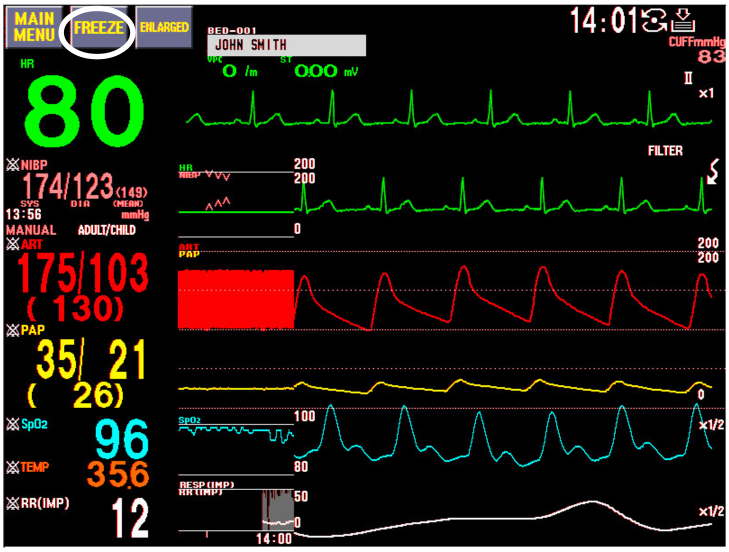
PWTT

Auto NIBP measurement triggered by a change in PWTT.

Freezing Waveforms

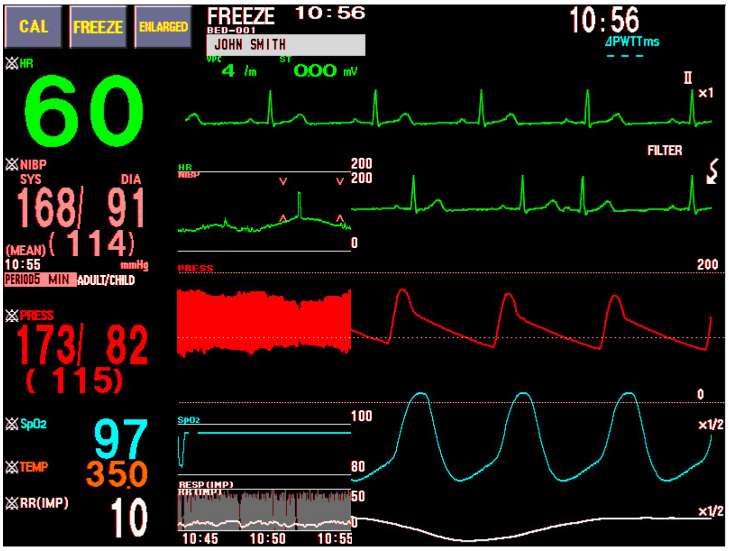
Normally, the waveforms continuously sweep across the screen. You can also “freeze” (stop sweeping) the waveforms. By freezing the waveforms, you can observe one part of a waveform in detail. The numerical data on the screen are not frozen.

To freeze waveforms, the freeze function must be assigned to one of the function keys in the upper left corner of the screen. Refer to “Assigning a Function to the Function Keys” in Section 4.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
14:01
CUFFmmHg 83
HR 80
VPC 0 /m
ST 0.00 mV
II ×1
FILTER
NIBP 174/123 (149)
SYS DIA (MEAN) mmHg
13:56
MANUAL ADULT/CHILD
ART 175/103 (130)
PAP 35/ 21 (26)
SpO2 96
TEMP 35.6
RR(IMP) 12
200
0
100
80
50
×1/2
14:00

When the freeze function is assigned to a function key, waveforms on the monitoring screen can be frozen any time by touching the “FREEZE” key. The waveforms are frozen for 3 minutes or until they are unfrozen.

When the waveforms are frozen, the “FREEZE” message appears with the frozen time.


CAL
FREEZE
ENLARGED
FREEZE 10:56
BED-001
JOHN SMITH
10:56
ΔPWTTms
HR 60
VPC 4 /m
ST 0.00 mV
II ×1
FILTER
NIBP
SYS DIA
168/ 91
(MEAN) (114)
10:55 mmHg
PERIOD5 MIN ADULT/CHILD
PRESS 173/ 82 (115)
SpO2 97
TEMP 35.0
RR(IMP) 10
200
0
100
80
50
×1/2
10:45 10:50 10:55

To unfreeze the waveforms, touch any key on the screen or press any key on the front panel.

Using Sleep Mode

In sleep mode, the screen is darkened and sync sound is turned off. The sleep mode is available only when the site mode is set to ICU or NICU. To change the site mode, refer to Section 3.

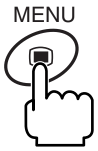
Use this mode when you want to prevent the monitor from disturbing the patient, such as during sleep.

When EXIT SLEEP MODE ON ALARM on the SYSTEM SETUP screen is set to:
YES: Sleep mode is turned off and the monitoring screen appears on the alarm occurrence.
NO: Sleep mode continues even on an alarm occurrence.
Refer to Section 3.

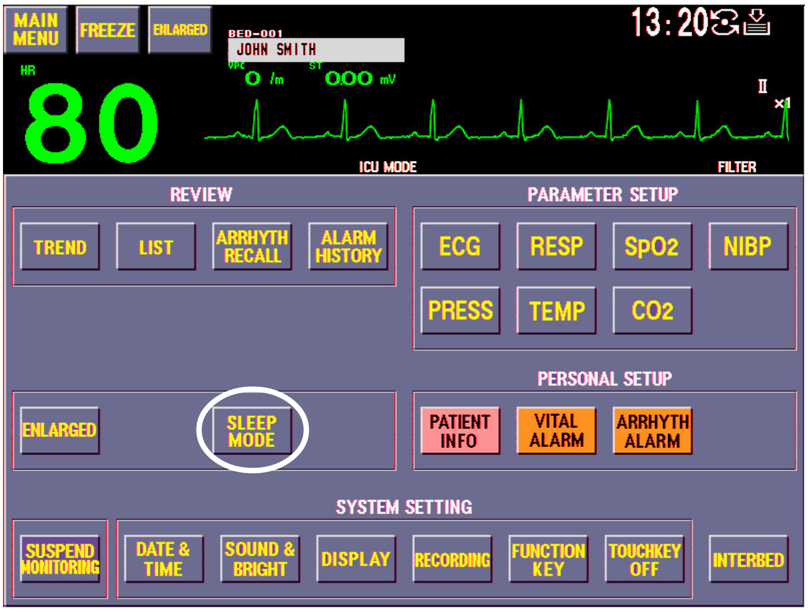
WARNING

When EXIT SLEEP MODE ON ALARM is set NO, the bedside monitor alarm cannot be seen or heard on the bedside monitor during sleep mode. Monitor the bedside monitor alarm on the central monitor or telemetry system. Otherwise, the bedside monitor alarm may be overlooked.

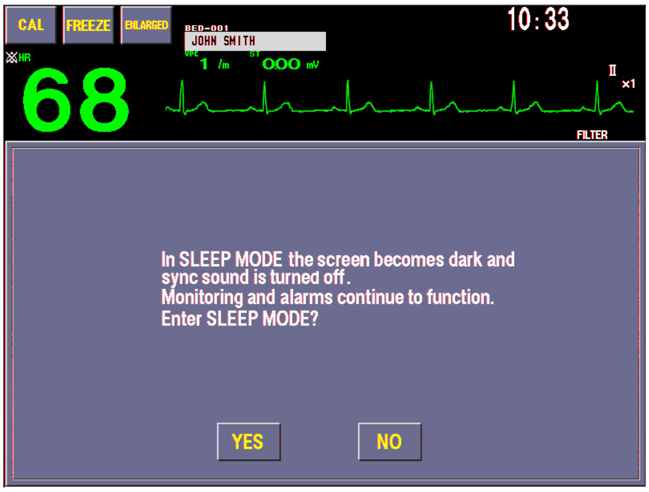
Turning Sleep Mode On



1. Press the MENU key on the front panel. The MENU window appears.

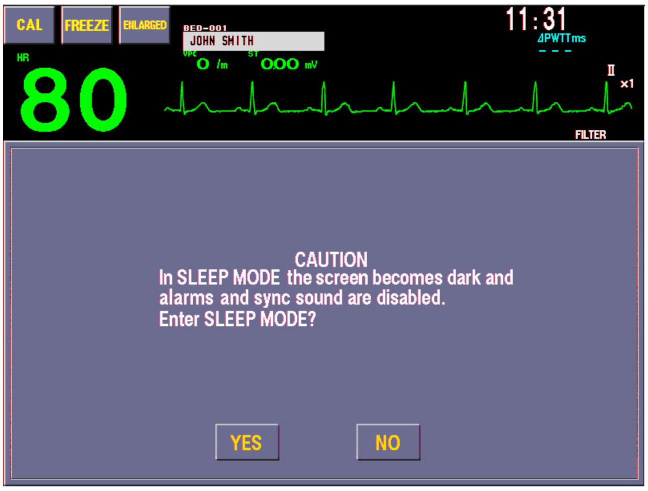

MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC
0 /m
ST
0.00 mV
II
×1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

2. Touch the “SLEEP MODE” key. The message appears to confirm if the sleep mode should be set.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
10:33
HR
68
VPC
1 /m
ST
0.00 mV
II
×1
FILTER
YES
NO

In SLEEP MODE the screen becomes dark and sync sound is turned off.
Monitoring and alarms continue to function.
Enter SLEEP MODE?

When EXIT SLEEP MODE ON ALARM on the SYSTEM SETUP screen is set to YES


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
11:31
ΔPWTTms
- - -
HR
80
VPC
0 /m
ST
0.00 mV
II
×1
FILTER
YES
NO

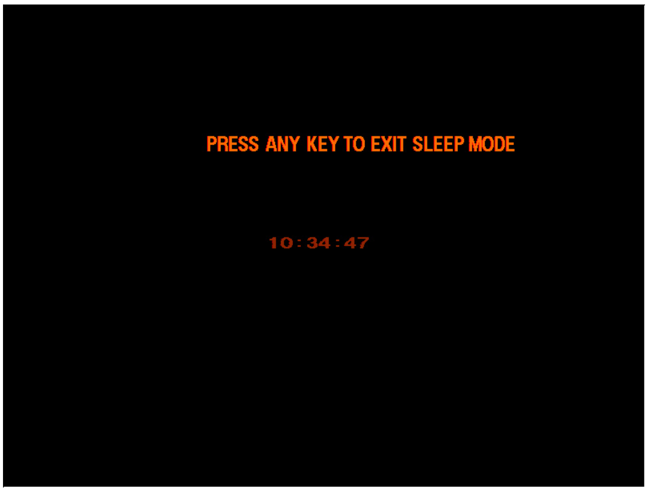
CAUTION
In SLEEP MODE the screen becomes dark and alarms and sync sound are disabled.
Enter SLEEP MODE?

When EXIT SLEEP MODE ON ALARM on the SYSTEM SETUP screen is set to NO

3. Select “YES” to set the sleep mode.

   Select “NO” to cancel setting the sleep mode.

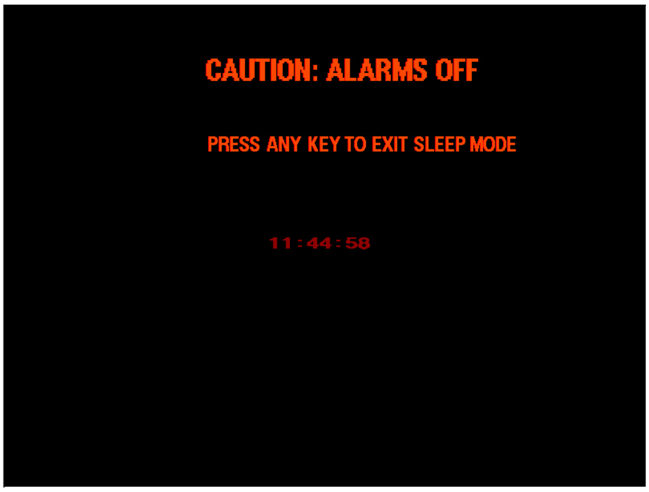
During the sleep mode, the following screen is displayed.



PRESS ANY KEY TO EXIT SLEEP MODE

10:34:47

When EXIT SLEEP MODE ON ALARM on the SYSTEM SETUP screen is set to YES



CAUTION: ALARMS OFF

PRESS ANY KEY TO EXIT SLEEP MODE

11:44:58

When EXIT SLEEP MODE ON ALARM on the SYSTEM SETUP screen is set to NO

Turning Sleep Mode Off

Touch the screen, press any hard key on the front panel or touch anywhere on the screen.

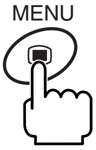
When the sleep mode is turned off by pressing a hard key, the function of that hard key is also performed. For example, if the ◇/▽ NIBP START/STOP key is pressed, NIBP measurement in manual mode is performed.

Displaying the Large Numeric Window

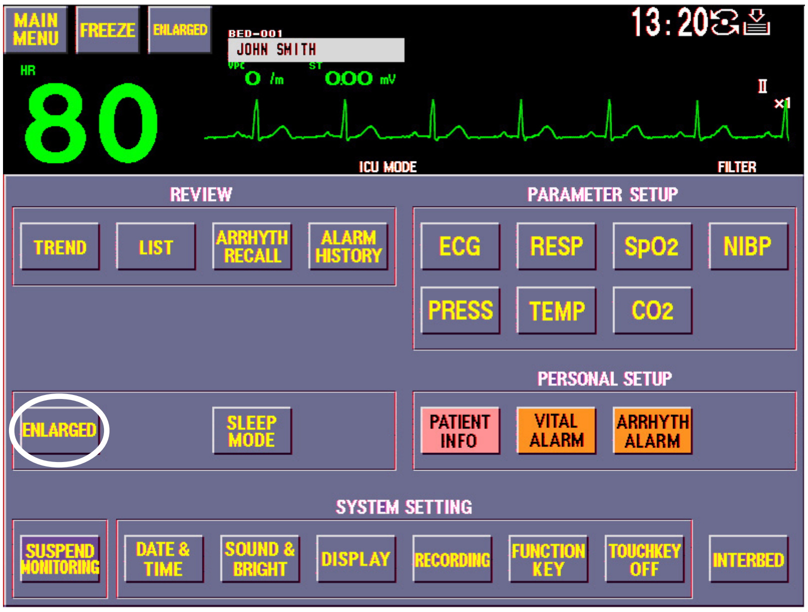
The numeric data of all monitoring parameters are enlarged on the ENLARGED window. This window is useful for viewing at a distance.

When respiration by impedance method and respiration by thermistor method or CO_2 are monitored at the same time, the respiration rate data on the ENLARGED window is detected in the following priority.

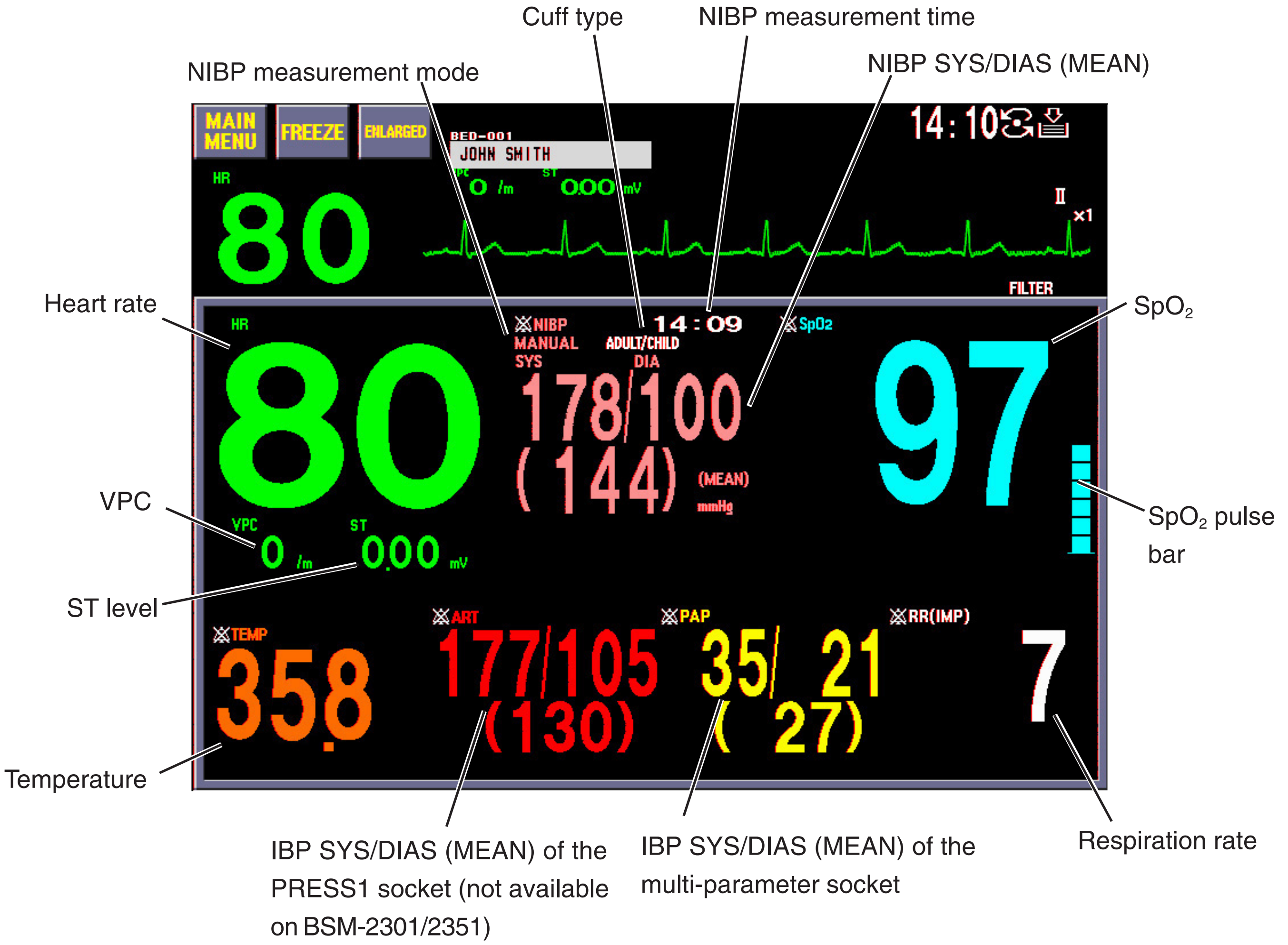
CO_2, respiration by thermistor, respiration by impedance

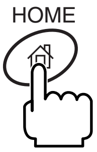


1. Press the MENU key on the front panel. The MENU window appears.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC
0 /m
ST
0.00 mV
II
×1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
ENLARGED
SLEEP MODE
PERSONAL SETUP
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

2. Touch the “ENLARGED” key. The ENLARGED window appears.


Cuff type
NIBP measurement time
NIBP measurement mode
NIBP SYS/DIAS (MEAN)
MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
14:10
HR
80
VPC 0 /m
ST 0.00 mV
II
×1
FILTER
Heart rate
HR
80
NIBP
MANUAL
ADULT/CHILD
14:09
SYS
DIA
178/100
(144)
(MEAN)
mmHg
SpO2
97
SpO_2
VPC
VPC
0 /m
ST
0.00 mV
ST level
SpO_2 pulse bar
TEMP
35.8
ART
177/105
(130)
PAP
35/ 21
(27)
RR(IMP)
7
Temperature
IBP SYS/DIAS (MEAN) of the PRESS1 socket (not available on BSM-2301/2351)
IBP SYS/DIAS (MEAN) of the multi-parameter socket
Respiration rate



3. Press the HOME key on the front panel to return to the monitoring screen.

Section 6 Alarm Function

Overview of Alarms 6.2
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This section explains:

- An overview of alarms.
- Alarm types.
- Alarm indications.
- Silencing an alarm.
- Suspending all alarms before occurrence.
- Setting individual alarms, turning automatic alarm recording on or off and all other functions for alarms.

Overview of Alarms

What is an Alarm

When the monitor detects an abnormal patient condition, it can generate an alarm sound, screen indication, and alarm lamp indication. You can set each individual alarm condition. There are four types of alarms: vital signs, arrhythmias, parameter and other alarms, and three levels of alarm: crisis, warning and advisory. The different alarm types are fully explained in the "Alarm Types" section and different alarm levels are explained in the "Alarm Indications" section.

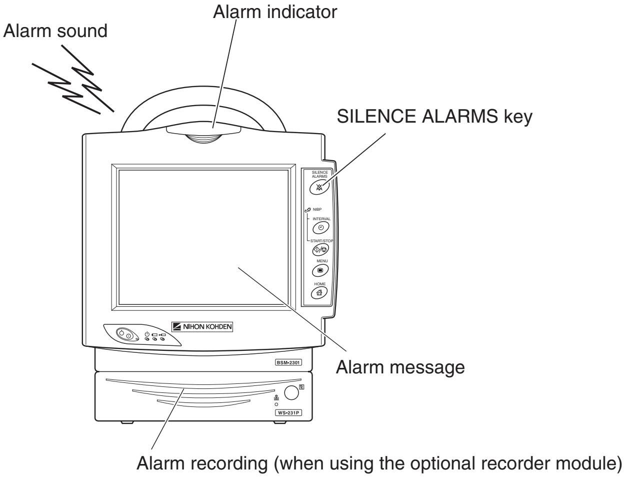
WARNING

When admitting a new patient, check the alarm settings. The alarm settings return to the alarm master settings on the SYSTEM SETUP screen when all data is deleted on the DELETE ALL window or 30 minutes elapse after monitor power off.

NOTE

When the monitor is in STANDBY MODE,

- **"CHECK ELECTRODES", "CHECK PROBE", "CANNOT DETECT PULSE" and "CHECK SENSOR" alarms will not be activated.**
- **"DETECTING PULSE"message will not be displayed.**



Alarm Level

There are three alarm levels.

CRISIS:	Patient is in a critical condition and patient life may be at risk. Immediate action must be taken. Electrodes or probe off, or incorrect lead or other cable connections may also cause this alarm.
WARNING:	Patient is in a critical condition. Prompt action should be taken. Electrodes or probe off, or incorrect lead or other cable connections may also cause this alarm.
ADVISORY:	Electrodes, probe, cuff, lead and other cable connections or settings on the monitor are not appropriate for accurate measurement. Prompt action should be taken.

Alarm Priority

When several alarms occur at the same time, the alarm with the highest alarm level is indicated. The heart rate (pulse rate) alarm is always displayed regardless of the alarm level.

Silencing and Suspending Alarms

You can temporarily silence current alarm sounds and indications for a 1 or 2 minute period. See the “Silencing/Suspending Alarms” section. You can also silence an interbed alarm from this bedside monitor but the alarm silence time depends on the setting on the alarmed bed. For interbed alarms, refer to Section 9.

All alarms can also be suspended before they occur. See the “Silencing/Suspending Alarms” section. This monitor has three types of alarm suspension:

- Suspending all alarms for two minutes. For example: for electrode replacement, etc.
- Suspending all alarms and NIBP STAT and Auto measurements indefinitely (by pressing SUSPEND MONITORING or BYPASS key). For example: when the patient is connected to a heart-lung machine or being examined.
- Suspending all alarms indefinitely (by pressing ALL ALARMS OFF key).

WARNING

During alarm suspension, all alarms are turned off.

The SUSPEND MONITORING key is only available in ICU or NICU mode. The BYPASS key is only available in OR mode. The site mode is set on the SYSTEM SETUP screen. Refer to Section 3.

Either the SUSPEND MONITORING/BYPASS key or ALL ALARMS OFF key is displayed on the MENU window. The key to be displayed on the MENU window is set on the SYSTEM SETUP screen. Refer to Section 3.

Alarm Master

For fast and easy alarm setup, a group of alarm items can be set all together at one time. For example, there may be typical alarm settings at your hospital, or you may have certain alarm settings for certain patients. There is one alarm master for vital signs, one alarm master for arrhythmias and one alarm master for gas related parameters.

Even when alarms are set by an alarm master, individual alarm settings can still be changed on the VITAL ALARM and ARRHYTH ALARM windows or the alarm setting window of each parameter window. See the “Setting Alarm” section.

Automatic Recording

With an optional WS-231P recorder module, you can set the monitor to automatically record ECG waveforms and data when an alarm occurs. See the “Turning Automatic Alarm Recording On/Off” section.

If a higher level alarm occurs during another alarm recording, the present alarm recording is cancelled and the higher level alarm is recorded.

Alarm Setting

Usually, alarms are set before monitoring, but alarms can be set or changed anytime without interrupting monitoring.

If you turn the bedside monitor power off, all alarm settings return to the alarm master settings of the SYSTEM SETUP screen 30 minutes later.

To set a parameter alarm to off, set the upper and lower limits to OFF.

Adjusting Alarm Sound Volume

The alarm sound volume can be adjusted on the SOUND & BRIGHT window. Refer to “Changing Sound Settings” in Section 4.

Standby Mode

When the monitor power is turned on, it enters “standby mode” while the monitor is waiting for the electrodes and probe to be attached to the patient. “CHECK ELECTRODES”, “CHECK PROBE”, “CANNOT DETECT PULSE” and “CHECK SENSOR” alarms will not be activated. “DETECTING PULSE” message will not be displayed. The ECG or SpO_2 monitoring starts when the connection cord is connected to the socket on the monitor and electrodes or probe is attached to the patient.

CAUTION

During standby mode, the parameter alarms do not function and only the following message is displayed on the screen.

Parameter	Displayed Message	Instead of
ECG	ATTACH ELECTRODES	CHECK ELECTRODES
SpO_2	ATTACH PROBE	CHECK PROBE DETECTING PULSE CANNOT DETECT PULSE
Temperature and CO_2	ATTACH SENSOR	CHECK SENSOR

Alarm History Window

The date and time, type of parameter and alarm message is saved as a file on an alarm occurrence. These data can be viewed on the ALARM HISTORY window. Refer to “Alarm History Window” in Section 7.

Interbed Alarm

When the bedside monitor is connected to a central monitor network, the bedside monitor data can be sent to the central monitor. The bedside monitor can display monitoring data of up to 8 other beds in the network on the INTERBED window. When an alarm occurs at an interbed bed, the “ALARM bed name” message appears on the monitoring screen of this bedside monitor if you have previously registered the other bed as an “interbed” bed on the INTERBED window. The interbed alarm can be silenced from this bedside monitor. The alarm silence time depends on the setting on the alarmed bed. The interbed alarm can only be suspended on the alarmed bed. The cause of the interbed alarm can only be seen on the central monitor or the interbed bed. Interbed alarm on or off can also be set. Refer to Section 9.

When this monitor is monitored by another monitor with the interbed function, the other monitor can silence alarms on this monitor.

Alarm Types

Alarms are divided into 4 categories: vital signs, arrhythmia, parameter and other alarms. The alarm name is displayed on the screen when an alarm occurs. For the vital signs and arrhythmia alarms, waveforms and data can be recorded on the optional recorder module in automatic alarm recording.

For the alarm types which are not classified into alarm levels, only the message is displayed.

Vital Signs Alarms

Alarm Name	Description
Heart rate (numeric data)	High/low limit exceeded
ST ALARM	High/low limit exceeded
SpO_2 ALARM	High/low limit exceeded
NIBP ALARM	High/low limit exceeded (systolic/diastolic mean)
PR (pulse rate) ALARM	High/low limit exceeded
APNEA ALARM	Limit exceeded
P1/P2 ALARM	High/low limit exceeded
TEMP ALARM	High/low limit exceeded
RR (respiration rate) ALARM	High/low limit exceeded
CO_2 ALARM	High/low limit exceeded

P2 alarm is not available on BSM-2301/2351.

Arrhythmia Alarms

Arrhythmia name	Description
ASYSTOLE	Longer than 3 to 10 seconds (selectable) with no QRS complex.
VF	Ventricular fibrillation.
VT	Ventricular tachycardia. 9 or more consecutive VPCs.
VPC RUN	VPC short run. 3 to 8 (selectable) consecutive VPCs.
COUPLET	VPC couplet (paired VPCs). 2 consecutive VPCs.
EARLY VPC	Early VPC. VPC with a time interval from the preceding normal QRS complex that is shorter than approx. one-third of the normal R-R interval.
BIGEMINY	Ventricular bigeminy. 3 or more consecutive pairs of VPC and normal QRS.
FREQ VPC	Frequent VPCs. VPC rate (beat/min) reaching or exceeding the preset limit of 1 to 50 beat/min (selectable).
TACHYCARDIA	Tachycardia. Exceeding the upper heart rate limit.
BRADYCARDIA	Bradycardia. Dropping below the lower heart rate limit.

Parameter Alarms

ECG Related Alarms

Alarm Name	Description
CHECK ELECTRODES	Electrode loose or disconnected.
NOISE	(If condition continues for more than 30 seconds) Too much noise preventing analysis.

Respiration Related Alarms

Alarm Name	Description
CHECK SENSOR	Respiration pickup is damaged.
CONNECTOR OFF	Respiration pickup cable is disconnected from the socket during monitoring.

SpO_2 Related Alarms

Alarm Name	Description
CANNOT DETECT PULSE	Pulse cannot be detected.
CHANGE PROBE	SpO2 probe or connection cord is damaged.
CHECK PROBE	Finger probe is not attached to the patient firmly or the amount of transmitted light is too small to measure.
LIGHT INTERFERE	A surgical light, bilirubin lamp, or sunlight is close to the probe.
CONNECTOR OFF	SpO2 connection cord is disconnected from the SpO2 socket during monitoring.

NIBP Related Alarms

Alarm Name	Description
CANNOT DETECT PULSE	Measurement cannot be performed because the patient’s pulse wave is small, the cuff or hose leaks air, the cuff hose is obstructed or the cuff is not connected.
CUFF OCCLUSION	The cuff pressure does not decrease after measurement has completed.
NIBP SAFETY CIRCUIT RUNNING	Instrument automatically stopped inflating.
AIR LEAK	Cuff pressure does not change after inflation. The cuff or air hose may be damaged.
SYSTOLIC OVER	Systolic value is outside the measurable range.
MEAS TIME-OUT	The measuring time exceeded the specified time.
CONNECTOR OFF	NIBP hose is disconnected from the cuff socket during monitoring.

IBP Related Alarms

Alarm Name	Description
CHECK SENSOR	Blood pressure transducer is disconnected from the IBP connection cord or the IBP connection cord is damaged.
CONNECTOR OFF	IBP connection cord is disconnected from the socket during monitoring.

CO_2 Related Alarms

Alarm Name	Description
CHECK SENSOR	Insufficient sensor light.
CHANGE SENSOR	The CO_2 sensor is damaged.
CHANGE ADAPTER	The CO_2 adapter is damaged.
CONNECTOR OFF	CO_2 connection cord is disconnected from the socket during monitoring.

Temperature Related Alarms

Alarm Name	Description
CHECK TEMP SENSOR	Temperature probe is damaged.
CONNECTOR OFF	Temperature probe cable is disconnected from the TEMP socket during monitoring.

Other Alarms

Alarm Name	Description
BATTERY WEAK	Battery is getting weak.
PARAMETER NOT AVAILABLE	The connection cord of the parameter which cannot be monitored on this monitor is connected to the multi-parameter socket.
INSERT NETWORK CARD	The optional QI-101P network card or QI-111P network printer card is disconnected from the monitor.
PARAMETER DUPLICATED	More than the specified number of channels are used for a parameter.
CANNOT PRINT	Printing failed.

Messages

The following messages are monitoring information and are not considered alarms.

ECG Related Messages

Message	Description
ATTACH ELECTRODES	Attach electrodes to the patient and connect the ECG connection cord (in standby mode).
PACING	Pacing spike is detected. (PACING DETECT is set to ON.)
LEARNING	Learning QRS for arrhythmia analysis.
ARRHYTHMIA ANALYSIS OFF	Arrhythmia analysis is turned off.
NOISE	(During the first 30 seconds) Too much noise preventing analysis.
AUTO LEAD CHANGE	Monitoring lead is being changed by auto lead change function.

Respiration Related Messages

Message	Description
RESP OFF	Respiration monitoring in impedance mode is turned off.

SpO_2 Related Messages

Message	Description
ATTACH PROBE	Attach probe to the patient and connect the SpO2 connection cord (in standby mode).
DETECTING PULSE	Auto gain control is being done. When the message is displayed for more than 20 seconds, the detected pulse is too small to measure.
CHECK PROBE SITE	The probe is not attached to the appropriate site or the probe is damaged.
M (highlighted)	Pulse waveform is not stable.
WEAK PULSE	Poor peripheral circulation.
SpO2 MODULE ERROR	SpO2 hardware malfunction.

NIBP Related Messages

Message	Description
WEAK PULSE	Patient's pulse is small.
HIGH CUFF PRESS	Excessive pressure is applied by the cuff.
REMEASURING	Remeasuring NIBP.
ZERO CALIBRATING	NIBP zero balance adjustment is performed.
NIBP MODULE ERROR	NIBP module malfunction.
NIBP MODE CHANGED	Cuff type is changed.
INFLATION PRESS LOW	Insufficient cuff inflation pressure.
PLEASE WAIT	Measurement and cuff inflation started before the cuff is deflated enough.

IBP Related Message

Message	Description
OUT OF RANGE	The measured value is outside the measurable range.
ZERO IMBALANCE	Zero balance is not adjusted.
ZERO OUT OF RANGE	Cannot adjust zero balance.
ZEROING COMPLETE	Zero balance adjustment is complete.
ZERO UNSTABLE	Unstable zero balance.

Temperature Related Message

Message	Description
ATTACH SENSOR	Attach sensor to the patient and connect the TEMP connection cord (in standby mode).

CO_2 Related Messages

Message	Description
CAL??	Zero calibration is not performed when using TG-950P CO_2 sensor kit.

Other Messages

Message	Description
ALARM SILENCED	Alarm is suspended.
DIFFERENT ALARM SILENCED	Another alarm is suspended during alarm suspension.
REMAINING SUSPEND TIME: X min	Remaining suspended time.
INSERT REC PAPER	No recording paper.
CLOSE PAPER MAGAZINE	Recorder door is open.
CALIBRATING	Monitor is calibrated.
FREEZE	Waveforms are frozen.
TOUCH KEY OFF	Touch key function is turned off.
NETWORK CARD ERROR	Network card malfunction.
ALARM bed name	An alarm occurred on an interbed bed.
PRINTING	Printing now.
ALL ALARMS OFF	All alarms are OFF.
MPU MODULE ERROR	MPU circuit malfunction.
MPU FAILURE	MPU connector malfunction.
INVALID CARD	A card other than QI-101P network card or QI-111P network printer card is used.

INTERBED ALARM message

The interbed alarm indication depends on the INTERBED ALARM setting on the SETTING window of the INTERBED window. Refer to Section 9.

ON: The highlighted “ALARM bed name” message is displayed with three “bing” sound.

OFF: The non-highlighted “ALARM bed name” message is displayed.

Alarm Indications

Overview

The monitor can indicate alarms both visually and audibly:

- Alarm sound
- Alarm message or highlighted numeric data on the screen
- Alarm indicator: red or yellow lamp

Alarm control marks indicating that various alarm functions are turned off are also displayed.

There are two color display modes. The color mode and colors are set on the SYSTEM SETUP screen (refer to Section 3).

PARAMETER: Different colors can be set for each parameter. When an alarm occurs, the alarm parameter data is highlighted.

ALARM: The same color is set for all parameters. When an alarm occurs, the alarmed parameter color changes to red or yellow according to the alarm level set on the SYSTEM SETUP screen.

CRISIS:	red
WARNING:	yellow
ADVISORY:	yellow

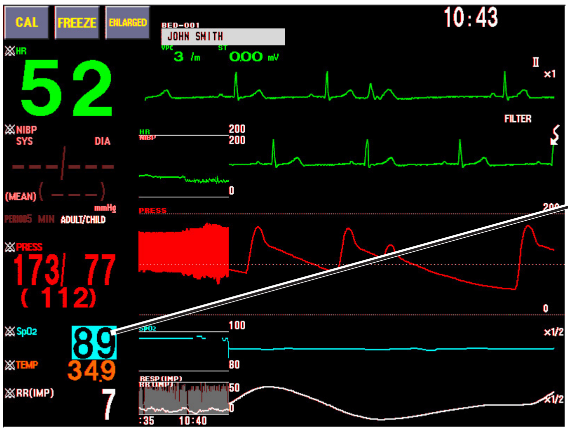
The alarm indicator indicates three alarm levels: crisis, warning and advisory. The red or yellow lamp blinks according to the alarm level.

CRISIS:	Blinking red
WARNING:	Blinking yellow
ADVISORY:	Lights in yellow

Individual Alarm Indications

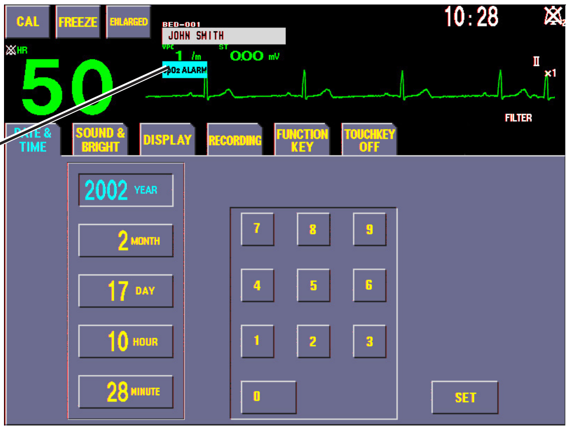
The HR, SpO_2, PRESS, NIBP, APNEA and arrhythmia (TACHYCARDIA, BRADYCARDIA, VPC RUN, COUPLET, EARLY VPC, BIGEMINY and FREQ VPC) alarm level can be set to either CRISIS, WARNING or ADVISORY on the SYSTEM SETUP screen. Refer to Section 3.

Vital Signs Alarms


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
10:43
HR
52
NIBP
SYS
DIA
(MEAN)
PRESS
173/ 77
(112)
SpO2
89
TEMP
34.9
RR(IMP)
7
FILTER

Monitoring screen

Alarm indication


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
10:28
HR
50
SpO2 ALARM
FILTER
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
2002 YEAR
2 MONTH
17 DAY
10 HOUR
28 MINUTE
7
8
9
4
5
6
1
2
3
0
SET

When a window is opened

Alarm	**Alarm level**	**Alarm sound**	**Alarm display**		**Sound/ display duration**	**Alarm indicator LED**
			Monitoring screen	**When a window is open**		
HR*/ PR**	CRISIS	Continuous “pips”	Blinking highlighted numeric data	—	During detection	Blinking red
	WARNING	Continuous “bing bongs”	Highlighted numeric data			Blinking yellow
	ADVISORY	“Bong” every 20 seconds	Highlighted numeric data			Lights in yellow
VPC	CRISIS	Continuous “pips”	Blinking highlighted numeric data	—	During detection	Blinking red
	WARNING	Continuous “bing bongs”	Highlighted numeric data			Blinking yellow
	ADVISORY	“Bong” every 20 seconds	Highlighted numeric data			Lights in yellow
ST	WARNING	Continuous “bing bongs”	Highlighted numeric data	—	During detection	Blinking yellow
SpO_2	CRISIS	Continuous “pips”	Blinking highlighted numeric data	Highlighted “SpO2 ALARM” message	During detection	Blinking red
	WARNING	Continuous “bing bongs”	Highlighted numeric data			Blinking yellow
	ADVISORY	“Bong” every 20 seconds	Highlighted numeric data			Lights in yellow
PRESS	CRISIS	Continuous “pips”	Blinking highlighted numeric data	Highlighted “P1/P2 ALARM” message	During detection	Blinking red
	WARNING	Continuous “bing bongs”	Highlighted numeric data			Blinking yellow
	ADVISORY	“Bong” every 20 seconds	Highlighted numeric data			Lights in yellow
APNEA	CRISIS	Continuous “pips”	Highlighted “APNEA ALARM” message		During detection	Blinking red
	WARNING	Continuous “bing bongs”				Blinking yellow
	ADVISORY	“Bong” every 20 seconds				Lights in yellow
NIBP	CRISIS	Continuous “pips”	Blinking highlighted numeric data	Highlighted “NIBP ALARM” message	During detection	Blinking red
	WARNING	Continuous “bing bongs”	Highlighted numeric data			Blinking yellow
	ADVISORY	“Bong” every 20 seconds	Highlighted numeric data			Lights in yellow
TEMP	ADVISORY	“Bong” every 20 seconds	Highlighted numeric data	Highlighted “TEMP ALARM” message	During detection	Lights in yellow
RR	WARNING	Continuous “bing bongs”	Highlighted numeric data	Highlighted “RR ALARM” message	During detection	Blinking yellow
CO_2	WARNING	Continuous “bing bongs”	Highlighted numeric data	Highlighted “CO2 ALARM” message	During detection	Blinking yellow

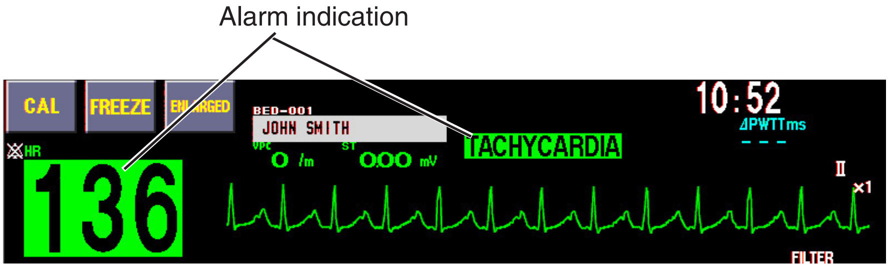
* When arrhythmia analysis is turned on, the “TACHYCARDIA” or “BRADYCARDIA” message also appears.

** PR alarm level is the same as PRESS or SpO_2 alarm level.

P2 ALARM is not available on BSM-2301/2351.

Arrhythmia Alarms

Alarm indication example

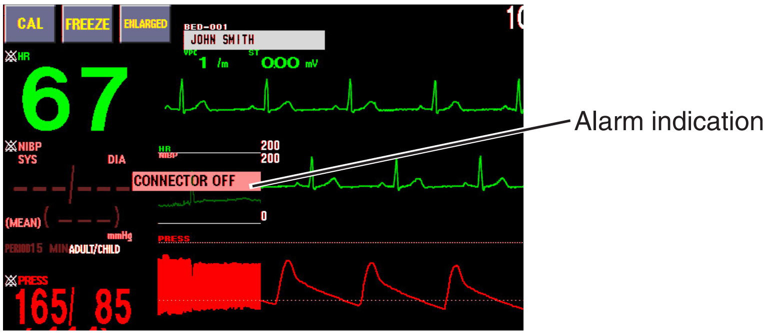

Alarm indication
CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
TACHYCARDIA
10:52
ΔPWTTms
HR
136
VPC 0 /m
ST 0.00 mV
II
×1
FILTER

Alarm	Alarm level	Alarm sound	Alarm display	Sound/display duration	Alarm indicator LED
ASYSTOLE VF VT	CRISIS	Continuous "pips"	Blinking highlighted message	During detection	Blinking red
TACHYCARDIA* BRADYCARDIA*	CRISIS	Continuous "pips"	Blinking highlighted numeric data and message	During detection	Blinking red
	WARNING	Continuous "bing bongs"	Highlighted numeric data and message		Blinking yellow
	ADVISORY	"Bong" every 20 seconds	Highlighted numeric data and message		Lights in yellow
VPC RUN COUPLET EARLY VPC FREQ VPC	CRISIS	Continuous "pips"	Blinking highlighted message	During detection	Blinking red
	WARNING	Continuous "bing bongs"	Highlighted message		Blinking yellow
	ADVISORY	"Bong" every 20 seconds	Highlighted message		Lights in yellow
BIGEMINY	ADVISORY	1 "bong"	Highlighted message	At detection	Lights in yellow

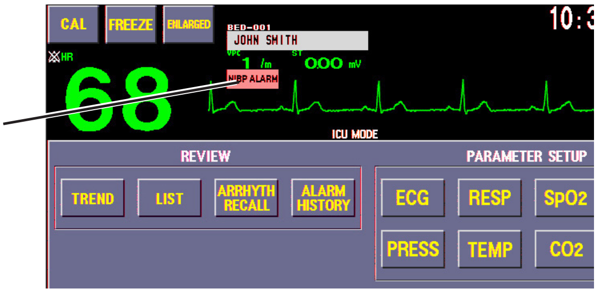
* When the HR alarm level and tachycardia or bradycardia alarm level differ, the higher level is used.

Parameter Alarms

Alarm indication example


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
HR
67
VPC 1 /m
ST 0.00 mV
NIBP
SYS
DIA
CONNECTOR OFF
(MEAN)
PERIOD 15 MIN ADULT/CHILD
mmHg
PRESS
165/ 85
200
200
0
Alarm indication

Monitoring screen


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
HR
68
VPC 1 /m
ST 0.00 mV
NIBP ALARM
ICU MODE
REVIEW
PARAMETER SETUP
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
ECG
RESP
SpO2
PRESS
TEMP
CO2

When a window is opened

Alarm	Alarm level	Alarm sound	Alarm display		Sound/ display duration	Alarm indicator LED
			Monitoring screen	When a window is open		
CONNECTOR OFF	ADVISORY	One "bong" every 20 seconds	Highlighted message	Highlighted (Parameter name) ALARM message	During detection	Lights in yellow

ECG related alarms

Alarm	Alarm level	Alarm sound	Alarm display	Sound/display duration	Alarm indicator LED
CHECK ELECTRODES	WARNING	Continuous “bing bongs”	Highlighted message	During detection	Blinking yellow
	ADVISORY	“Bong” every 20 seconds	Highlighted message		Lights in yellow
NOISE	WARNING	Continuous “bing bongs”	Highlighted message	(If noise continues for more than 30 seconds) During detection	Blinking yellow
	ADVISORY	“Bong” every 20 seconds	Highlighted message		Lights in yellow

Respiration related alarms

Alarm	Alarm level	Alarm sound	Alarm display	Sound/display duration	Alarm indicator LED
CHECK SENSOR	ADVISORY	“Bong” every 20 seconds	Highlighted message	During detection	Lights in yellow

SpO$_2$ related alarms

Alarm	Alarm level	Alarm sound	Alarm display		Sound/ display duration	Alarm indicator LED
			Monitoring screen	When a window is open		
CHANGE PROBE	WARNING	Continuous “bing bongs”	Highlighted message	Highlighted “SpO2 ALARM” message	During detection	Blinking yellow
CHECK PROBE CANNOT DETECT PULSE	WARNING	Continuous “bing bongs”	Highlighted message	Highlighted “SpO2 ALARM” message	During detection	Blinking yellow
	ADVISORY	“Bong” every 20 seconds	Highlighted message	Highlighted “SpO2 ALARM” message		Lights in yellow
PROBE DISCONNECT LIGHT INTERFERE	ADVISORY	“Bong” every 20 seconds	Highlighted message	Highlighted “SpO2 ALARM” message	During detection	Lights in yellow

NIBP related alarms

Alarm	Alarm level	Alarm sound	Alarm display		Sound/ display duration	Alarm indicator LED
			Monitoring screen	When a window is open		
CANNOT DETECT PULSE NIBP SAFETY CIRCUIT RUNNING SYSTOLIC OVER MEAS TIME-OUT CUFF OCCLUSION AIR LEAK	ADVISORY	“Bong” every 20 seconds	Highlighted message	Highlighted “NIBP ALARM” message	During detection	Lights in yellow

IBP related alarms

"P2 ALARM" is not available on BSM-2301/2351.

Alarm	Alarm level	Alarm sound	Alarm display		Sound/ display duration	Alarm indicator LED
			Monitoring screen	When a window is open		
CHECK SENSOR	ADVISORY	"Bong" every 20 seconds	Highlighted message	Highlighted "P1/P2 ALARM" message	During detection	Lights in yellow

CO$_2$ related alarms

Alarm	Alarm level	Alarm sound	Alarm display		Sound/ display duration	Alarm indicator LED
			Monitoring screen	When a window is open		
CHECK SENSOR CHANGE SENSOR CHANGE ADAPTER	ADVISORY	"Bong" every 20 seconds	Highlighted message	Highlighted "CO2 ALARM" message	During detection	Lights in yellow

Temperature related alarm

Alarm	Alarm level	Alarm sound	Alarm display		Sound/ display duration	Alarm indicator LED
			Monitoring screen	When a window is open		
CHECK TEMP SENSOR	ADVISORY	"Bong" every 20 seconds	Highlighted message	Highlighted "TEMP ALARM" message	During detection	Lights in yellow

Other Alarms

Alarm	Alarm level	Alarm sound	Alarm display	Sound/display duration	Alarm indicator LED
BATTERY WEAK PARAMETER NOT AVAILABLE PARAMETER DUPLICATED	WARNING	Continuous "bing bongs"	Highlighted message	During detection	Blinking yellow
INSERT NETWORK CARD CANNOT PRINT	ADVISORY	"Bong" every 20 seconds	Highlighted message	During detection	Lights in yellow

Alarm Control Marks

When certain alarm functions are not available, an alarm control mark is displayed in the upper right corner of the screen.

Alarm Silence Mark

Remaining minutes is indicated beside the bell. 🔕2

Alarm Recording Off Mark

Alarm recording is disabled.

Priority of Alarm Control Marks

If more than one alarm control condition exists at the same time, only the highest priority mark is displayed.

The priority, from high to low, is:

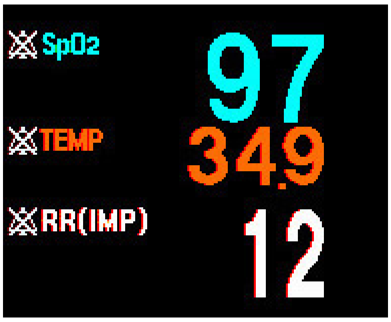
Alarm Silence mark, Alarm Recording Off mark

🔕2

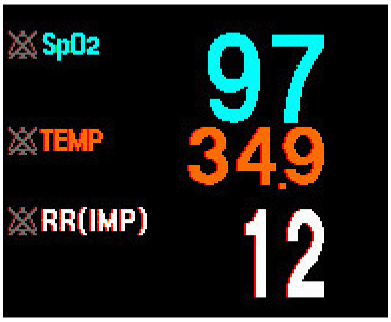
Individual Vital Signs Alarm Setting Indication

The 🔕 vital signs alarm off mark can be displayed at every parameter which has the vital signs alarm limit set to OFF. The upper/lower alarm limits can also be displayed at each parameter. This mark is not related to the above alarm control marks.

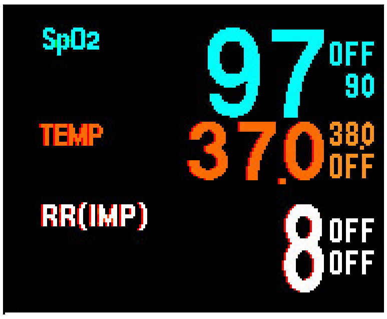
Set this setting at ALARM LIMIT DISPLAY of the ALARM SETUP on the SYSTEM SETUP screen. See Section 3.



ALARM LIMIT DISPLAY set to MARK BRIGHT



ALARM LIMIT DISPLAY set to MARK DIM



ALARM LIMIT DISPLAY set to VALUES

Adjusting the Alarm Sound Volume

The alarm sound volume can be adjusted on the SOUND & BRIGHT window. Refer to “Changing Sound Settings” in Section 4.

Silencing/Suspending Alarms

Overview

Silencing an Alarm

When an alarm occurs, you can silence the alarm sound and indications for one or two minutes. When a vital signs alarm or arrhythmia alarm is silenced, the alarm resumes after the alarm silence ends. When an alarm other than a vital signs or arrhythmia alarm is silenced, the alarm indication does not resume after the alarm silence ends. When several alarms occur together and the 🔕 SILENCE ALARMS key is pressed, all alarms are silenced.

Suspending All Alarms Before Occurrence

All alarms can also be suspended before they occur. During alarm suspension, all alarms are off. This monitor has three types of alarm suspension according to the site mode.

Monitor operation	Example of how this function is used	Key to press	How the alarm function comes back
Suspends all alarms for 2 minutes	For electrode replacement.	SILENCE ALARMS key on the front panel	When 2 minutes elapse.
			When the SILENCE ALARMS key is pressed again.
Suspends all alarms and NIBP STAT and Auto measurements indefinitely	When the patient is connected to a heart-lung machine or being examined.	SUSPEND MONITORING key on the screen (ICU and NICU mode only)	When the SUSPEND MONITORING key is pressed again.
			When HR, SpO_2, IBP or $EtCO_2$ is monitored properly for the time set on the SUSPEND ALARM TIME.
			When NIBP is measured.
		BYPASS key on the screen (OR mode only)	When the BYPASS key is pressed again.
Suspends all alarms indefinitely	When you want to turn off an unnecessary alarm in such situations as when the patient's vital signs are obviously out of normal range and the medical staff are aware that the patient is in an alarm condition and are currently treating the patient.	ALL ALARMS OFF key on the screen	When the ALL ALARMS OFF key is pressed again.

The SUSPEND MONITORING key is only available in ICU or NICU mode. The BYPASS key is only available in OR mode. The site mode is set on the SYSTEM SETUP screen. Refer to Section 3.

Either the SUSPEND MONITORING/BYPASS key or ALL ALARMS OFF key is displayed on the MENU window. The key to be displayed on the MENU window is set on the SYSTEM SETUP screen. Refer to Section 3.

For the interbed alarm, refer to Section 9.

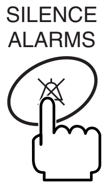
Silencing Alarms After Alarm Occurrence

During alarm silence,

- the suspended mark and the remaining minutes are displayed
- the alarm sound is silenced

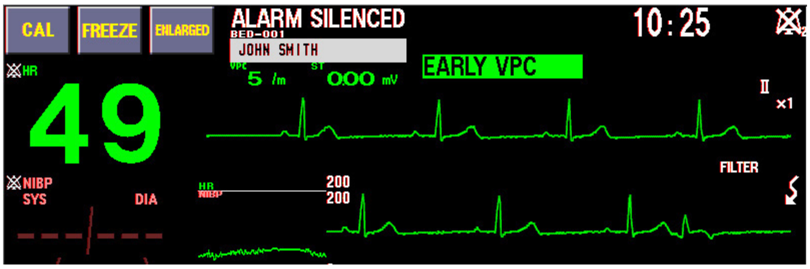
The alarm silence time can be set to either 1 or 2 minutes at the SYSTEM SETUP screen (Section 3). The default setting is 2 minutes.

If another alarm occurs during alarm silence, the alarm sound, indication and recording occur as usual. The alarm silence does not affect alarms which occur after the 🔕 SILENCE ALARMS key is pressed. (A new occurrence of the silenced alarm condition is treated as a different alarm.) When this alarm is silenced, the "DIFFERENT ALARM SILENCED" message appears and the alarm silence time is reset.



Silencing Alarm

Press the 🔕 SILENCE ALARMS key on the front panel. The "ALARM SILENCED" message and an alarm silenced mark with the minutes remaining in the alarm silence are displayed on the screen.



ALARM SILENCED

EARLY VPC

Canceling Alarm Silence

Vital sign and arrhythmia alarm silence can be cancelled by pressing the 🔕 SILENCE ALARMS key. The alarm silence mark disappears and all alarms are resumed. Parameter alarm and other alarm silence cannot be cancelled.

Suspending Alarms Before Alarm Occurrence

Suspending Alarms for Two Minutes

By pressing the 🔕 SILENCE ALARMS key, all alarms for the patient are suspended for 2 minutes.

During alarm suspension, all alarms are suspended and

- the "ALARMS SUSPENDED" message is displayed with the remaining suspension time
- the alarm sound is silenced
- all alarm recording is suspended.

WARNING

All alarms are suspended during the two minute alarm suspension.

Resuming Alarms

Alarms resume when two minutes elapses or when the 🔕 SILENCE ALARMS key is pressed again.

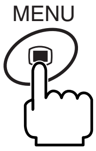
Suspending All Alarms and NIBP STAT and Auto Measurements Indefinitely

You can suspend all alarms and NIBP STAT and Auto measurements for an indefinite time by touching the “BYPASS” or “SUSPEND MONITORING” key on the MENU window.

The “SUSPEND MONITORING” or “BYPASS” key is displayed on the MENU window when it is selected at the ALARMS OFF TYPE on the SYSTEM SETUP screen. Refer to Section 3.

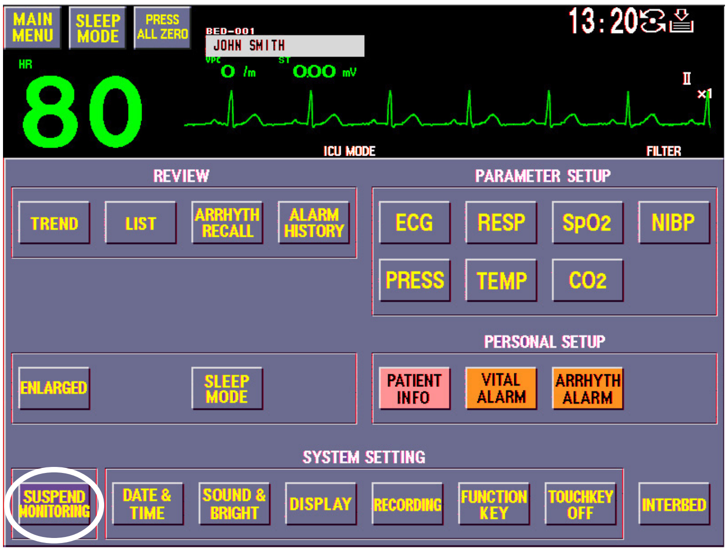
WARNING

- **All alarms are suspended for an indefinite period.**
- **Do not turn all alarms off with the BYPASS key when there is no medical staff around the patient.**

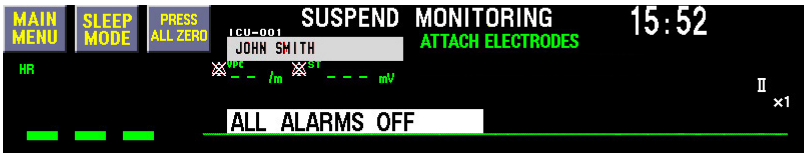


In ICU or NICU mode

1. Press the MENU key on the front panel. The MENU window appears.


MAIN MENU
SLEEP MODE
PRESS ALL ZERO
BED-001
JOHN SMITH
13:20
HR
80
VPC
0 /m
ST
0.00 mV
II
×1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

2. Touch the “SUSPEND MONITORING” key. The “SUSPEND MONITORING” and “ALL ALARMS OFF” messages appear on the screen.

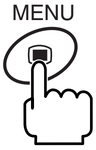

MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
15:52
HR
VPC
ST
/m
mV
II
×1

SUSPEND MONITORING
ATTACH ELECTRODES
ALL ALARMS OFF

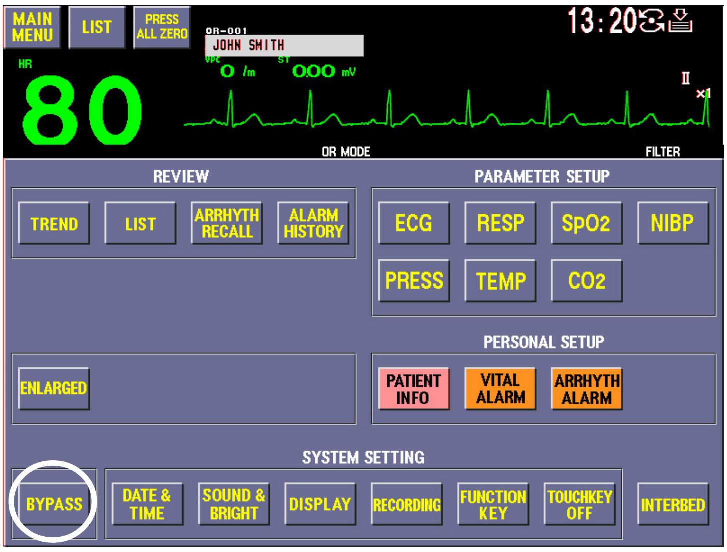
To resume alarms, touch the “SUSPEND MONITORING” key again. In ICU or NICU mode, alarms resume and the “SUSPEND MONITORING” key returns to the off position when heart rate, SpO_2, IBP or $EtCO_2$ is monitored properly for the time length set on the SUSPEND ALARM TIME on the SYSTEM SETUP screen or when NIBP is measured. For the time setting, refer to Section 3.

To resume NIBP measurement in STAT or Auto mode, press the ◇/⊚ NIBP START/STOP key. Refer to Section 13.

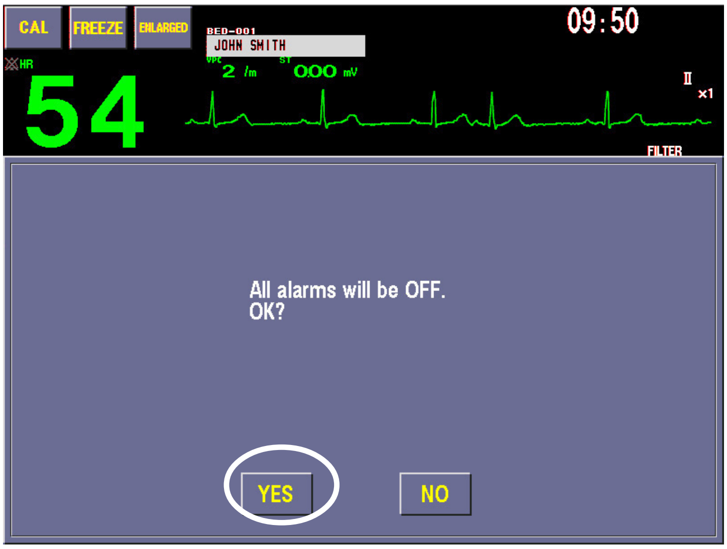
In OR mode



1. Press the MENU key on the front panel. The MENU window appears.


MAIN MENU
LIST
PRESS ALL ZERO
OR-001
JOHN SMITH
13:20
HR
80
VPC
0 /m
ST
0.00 mV
II
×1
OR MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
ENLARGED
PERSONAL SETUP
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
BYPASS
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

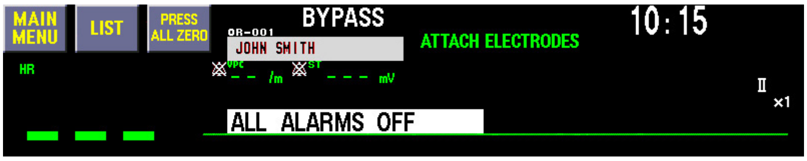
2. Touch the “BYPASS” key. The following window appears for confirmation.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
09:50
HR
54
VPC
2 /m
ST
0.00 mV
II
×1
FILTER
YES
NO

All alarms will be OFF.
OK?

3. Touch the YES key. If you wish to cancel, touch the NO key.

The “BYPASS” and “ALL ALARMS OFF” messages appear on the screen.


MAIN MENU
LIST
PRESS ALL ZERO
OR-001
JOHN SMITH
BYPASS
ATTACH ELECTRODES
10:15
HR
VPC
-- /m
ST
--- mV
II
×1
ALL ALARMS OFF

To resume alarms, touch the “BYPASS” key again. Alarms can only resume by touching the “BYPASS” key.

To resume NIBP measurement in STAT or Auto mode, press the ◇/▽ NIBP START/STOP key. Refer to Section 13.

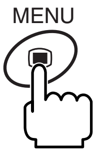
Suspending All Alarms Indefinitely

You can suspend all alarms for an indefinite time by touching the “ALL ALARMS OFF” key on the MENU window. When you start monitoring or during monitoring, you can use this function to temporarily turn all alarms off.

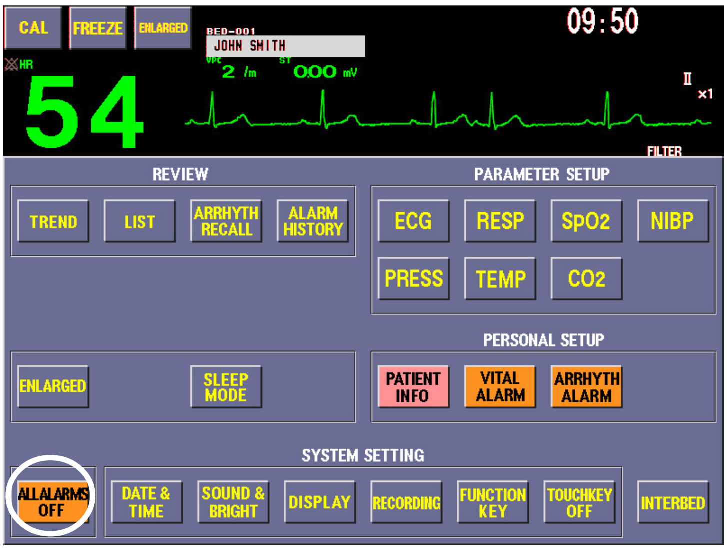
The “ALL ALARMS OFF” key is displayed on the MENU window when it is selected at the ALARMS OFF TYPE on the SYSTEM SETUP screen. Refer to Section 3.

WARNING

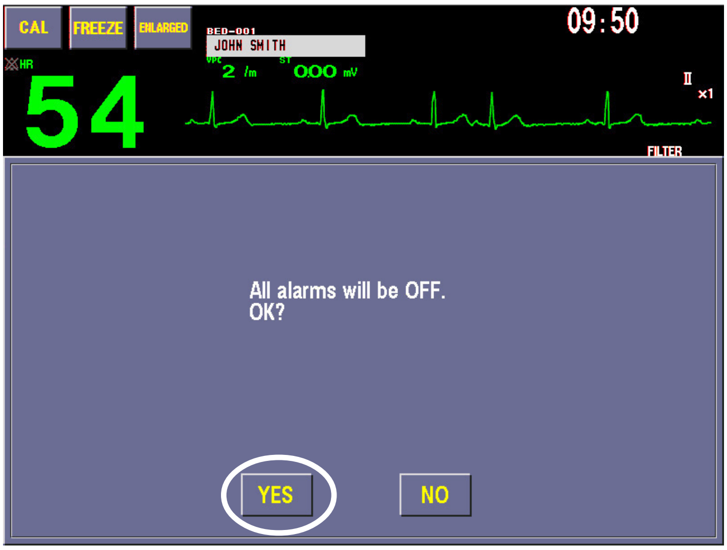
- **All alarms are suspended for an indefinite period.**
- **Do not turn all alarms off with the ALL ALARMS OFF key when there is no medical staff around the patient or when the patient is connected to a ventilator.**



1. Press the MENU key on the front panel. The MENU window appears.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
09:50
HR
54
VPC 2 /m
ST 0.00 mV
II
×1
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
ALL ALARMS OFF
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

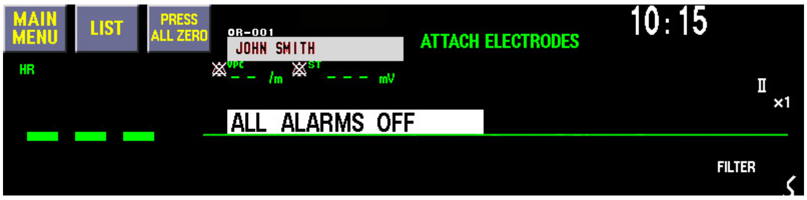
2. Touch the “ALL ALARMS OFF” key. The following window appears for confirmation.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
09:50
HR
54
VPC 2 /m
ST 0.00 mV
II
×1
FILTER
YES
NO

All alarms will be OFF.
OK?

3. Touch the YES key. If you wish to cancel, touch the NO key.

The “ALL ALARMS OFF” message appears on the screen.


MAIN MENU
LIST
PRESS ALL ZERO
OR-001
JOHN SMITH
10:15
HR
VPC - - /m
ST - - - mV
II
×1
FILTER

ATTACH ELECTRODES

ALL ALARMS OFF

To resume alarms, touch the “ALL ALARMS OFF” key again. Alarms can only resume by touching the “ALL ALARMS OFF” key.

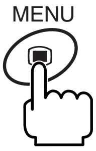
Turning Automatic Alarm Recording On/Off

If ALARM RECORDING on the RECORDING window is set to ON, waveforms beginning 8 seconds before and ending 12 seconds after the alarm are automatically recorded when an alarm is generated. If this setting is OFF, an All Vital Signs Alarm Recording Off mark appears at the upper right corner of the screen and the waveforms are not automatically recorded when an alarm occurs. You can still record waveforms manually.

Alarm recording can only be performed on the optional recorder module.

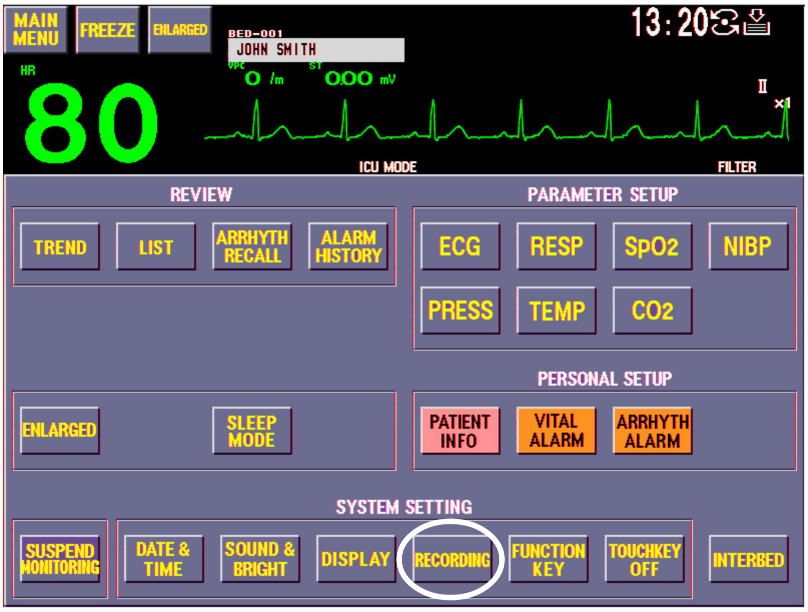
You can select which waveform(s) to record by changing the recording pattern. See Section 8.

To cancel recording while an automatic vital signs alarm is being recorded, press the record key on the recorder module.

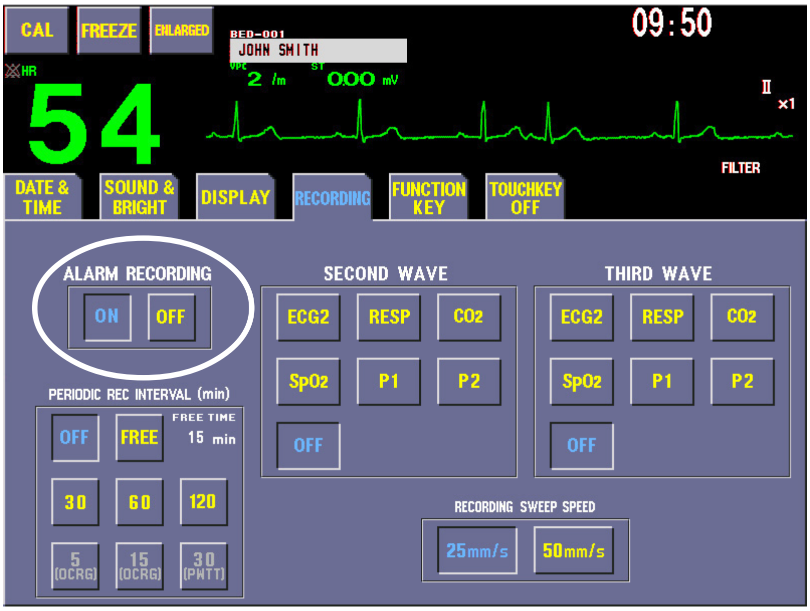


To set automatic vital signs alarm recording on or off:

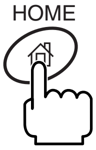
1. Press the MENU key on the front panel. The MENU window appears.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC
0 /m
ST
0.00 mV
II
×1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

2. Touch the “RECORDING” key to display the RECORDING window.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
09:50
HR
54
VPC
2 /m
ST
0.00 mV
II
x1
FILTER
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
ALARM RECORDING
ON
OFF
PERIODIC REC INTERVAL (min)
OFF
FREE
FREE TIME
15 min
30
60
120
5 (OCRG)
15 (OCRG)
30 (PWTT)
SECOND WAVE
ECG2
RESP
CO2
SpO2
P1
P2
OFF
THIRD WAVE
ECG2
RESP
CO2
SpO2
P1
P2
OFF
RECORDING SWEEP SPEED
25mm/s
50mm/s

3. Touch the “ON” or “OFF” key in the ALARM RECORDING box to set alarm recording on or off.



4. Press the HOME key on the front panel to return to the monitoring screen.

Setting Alarm

Overview

There are three ways to set alarm limits and on/off settings:

- Set all alarm limits at the same time on one window.
- Set a group of alarm items all together to a preset pattern using an alarm master.
- Set the alarms for individual parameters separately from the ECG, SpO_2, NIBP, IBP, respiration, CO_2 and temperature windows. See Sections 10 to 16.

Vital signs alarm limits can be set on two different windows: the VITAL ALARM window and the VITAL ALARM window for the individual parameter. When you change an alarm setting on one window, the same setting on the other window is also automatically changed.

Arrhythmia alarm limits can be set on two different windows: the ARRHYTH ALARM window and the ARRHYTH ALARM window of the ECG window. When you change an alarm setting on one window, the same setting on the other window is also automatically changed.

The alarm setting remains in memory for about 30 minutes after the monitor power off. After 30 minutes, the setting returns to the alarm master setting.

To set NIBP alarm limits for neonate, the cuff for neonates must be connected to the cuff socket on the monitor.

Alarm Limits Ranges

The following tables show the setting ranges for each alarm. Any upper and lower limit can also be set to off.

CAUTION

When the alarm limit is set to OFF, there will be no alarm for that limit.

Vital Signs Alarms

If the upper limit is set to a value above the maximum, or the lower limit is set to a value below the minimum, the alarm for that upper/lower limit is automatically set to OFF.

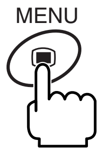
Parameter	Upper limit (Default setting)	Lower limit (Default setting)	Step
HR/PR (beats/min)	20 to 300, OFF (OR, ICU: 140 NICU: 180)	OFF, 15 to 295 (OR, ICU: 40 NICU: 80)	5
ST (mV)	−1.99 to +2.00, OFF (OFF)	OFF, −2.00 to +1.99 (OFF)	0.01
ST (mm)	−19.9 to +20.0, OFF (OFF)	OFF, −20.0 to +19.9 (OFF)	0.1
SpO_2 (%)	51 to 100, OFF (OFF)	OFF, 50 to 99 (90)	1
NIBP adult (mmHg/kPa)	15 to 260, OFF (S: 180, D: OFF, M: OFF) mmHg 1.5 to 35.0, OFF (S: 24.0. D: OFF, M: OFF) kPa	OFF, 10 to 255 (S: 80, D: OFF, M: OFF) mmHg OFF, 1.0 to 34.5 (S: 10.5, D: OFF, M: OFF) kPa	5 mmHg 0.5 kPa
NIBP neonate (mmHg/kPa)	15 to 260, OFF (S: 100, D: OFF, M: OFF) mmHg 1.5 to 35.0, OFF (S: 13.5. D: OFF, M: OFF) kPa	OFF, 10 to 255 (S: 50, D: OFF, M: OFF) mmHg OFF, 1.0 to 34.5 (S: 6.5, D: OFF, M: OFF) kPa	5 mmHg 0.5 kPa
IBP (P1) (mmHg/kPa)	2 to 300, OFF (mmHg) (ICU, OR S: OFF, D: OFF, M: OFF NICU S: OFF, D: OFF, M: OFF) 0.5 to 40.0, OFF (kPa) (ICU, OR S: OFF, D: OFF, M: OFF NICU S: OFF, D: OFF, M: OFF)	OFF, 0 to 298 (mmHg) (ICU, OR S: 80, D: OFF, M: 60 NICU S: 50, D: OFF, M: 30) OFF, 0.0 to 39.5 (kPa) (ICU, OR S: 10.5, D: OFF, M: 8.0 NICU S: 6.5, D: OFF, M: 4.0)	2 mmHg 0.5 kPa
IBP (P2) (mmHg/kPa)	2 to 300, OFF (S: OFF, D: OFF, M: OFF) mmHg 0.5 to 40.0, OFF (S: OFF, D: OFF, M: OFF) kPa	OFF, 0 to 298 (S: OFF, D: OFF, M: OFF) mmHg OFF, 0.0 to 39.5 (S: OFF, D: OFF, M: OFF) kPa	
RR (breaths/min)	2 to 150, OFF (OFF)	OFF, 0 to 148 (OFF)	2
Apnea (s)	5 to 40, OFF (20)	—	5
$EtCO_2$ (mmHg/kPa)	2 to 99, OFF (OFF) mmHg 1.5 to 13.5, OFF (OFF) kPa	OFF, 1 to 98 (OFF) mmHg OFF, 1.0 to 13.0 (OFF) kPa	1 mmHg 0.5 kPa
$FiCO_2$ (mmHg/kPa)	1 to 5, OFF (OR: 3 ICU, NICU: OFF) mmHg 0.1 to 0.7, OFF (OR: 0.5 ICU, NICU: OFF) kPa	—	1 mmHg 0.1 kPa
Temperature (°C/°F)	0.1 to 45.0, OFF (OR, ICU: 38.0 NICU: 39.0) °C 32 to 113, OFF (OR, ICU: 100 NICU: 102) °F	OFF, 0 to 44.9 (OFF) °C OFF, 31 to 112 (OFF) °F	0.1°C 1°F

P2 alarm is not available on BSM-2301/2351.

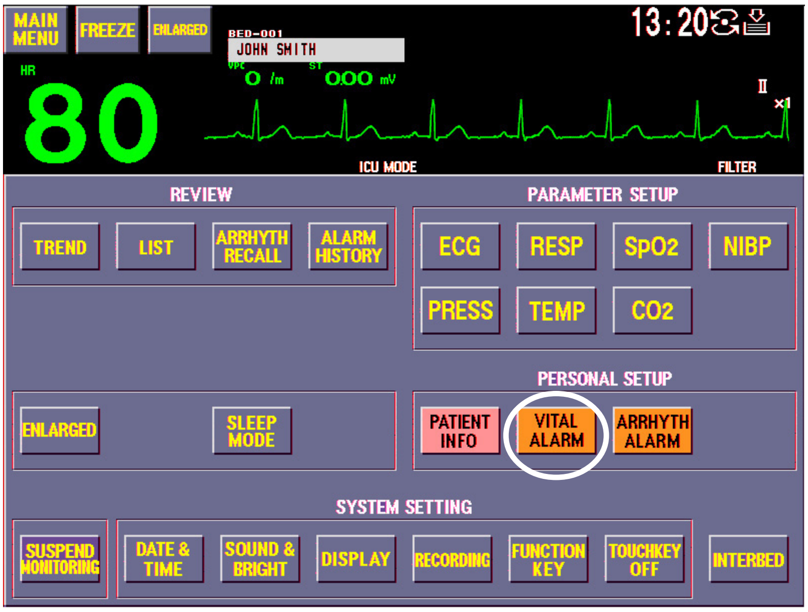
Arrhythmia Alarms

Parameter	Detection condition (Default setting)	Alarm ON/OFF setting (Default setting)
ASYSTOLE	3 to 10 seconds (OR, ICU: 5 s NICU: 3 s)	ON fixed
VF	—	ON fixed
VT	—	ON fixed
VPC RUN	3 to 8 VPCs (3 VPCs)	ON/OFF (OR, NICU: OFF ICU: ON)
COUPLET	—	ON/OFF (OFF)
EARLY VPC	—	ON/OFF (OFF)
BIGEMINY	—	ON/OFF (OFF)
FREQ VPC	1 to 50 VPCs/min (10 VPCs/min)	ON/OFF (OFF)

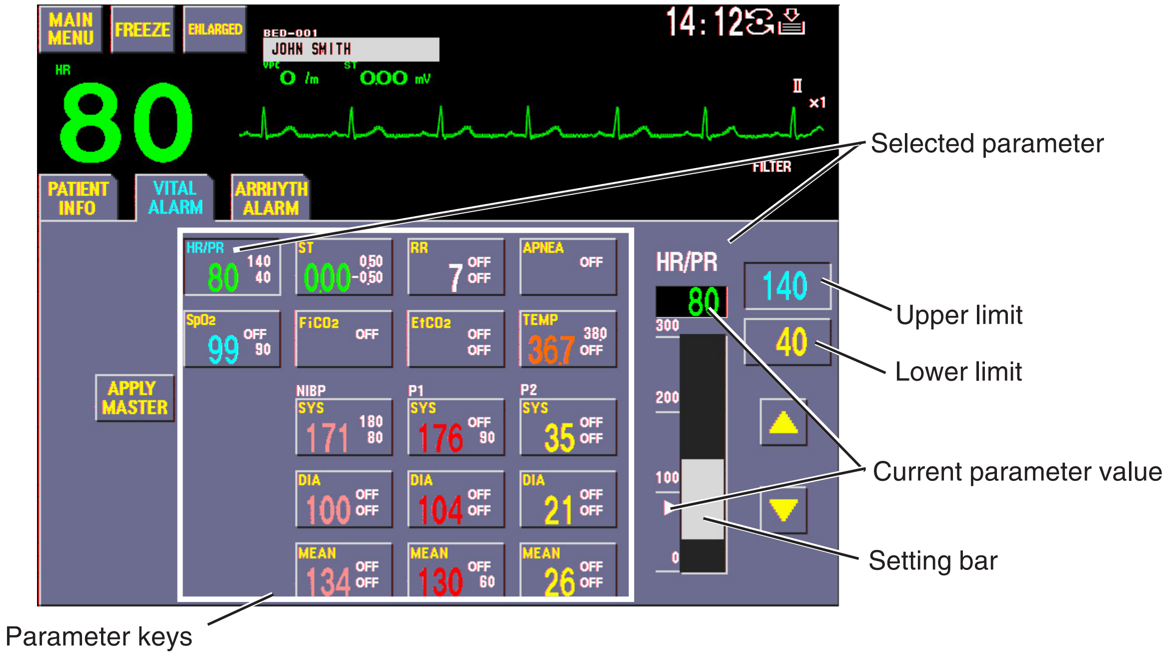
Setting Vital Signs Alarm Individually



1. Press the MENU key on the front panel. The MENU window appears.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC 0 /m
ST 0.00 mV
II
x1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

2. Touch the “VITAL ALARM” key. The VITAL ALARM window appears.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
14:12
HR
80
VPC 0 /m
ST 0.00 mV
II
x1
FILTER
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
APPLY MASTER
HR/PR 80 140 40
ST 0.00 0.50 -0.50
RR 7 OFF OFF
APNEA OFF
SpO2 99 OFF 90
FiCO2 OFF
EtCO2 OFF OFF
TEMP 36.7 38.0 OFF
NIBP SYS 171 180 80
P1 SYS 176 OFF 90
P2 SYS 35 OFF OFF
DIA 100 OFF OFF
DIA 104 OFF OFF
DIA 21 OFF OFF
MEAN 134 OFF OFF
MEAN 130 OFF 60
MEAN 26 OFF OFF
HR/PR
80
140
40
300
200
100
0
Selected parameter
Upper limit
Lower limit
Current parameter value
Setting bar
Parameter keys

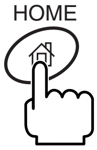
3. Touch the parameter key for the limit you want to change. P2 is not available on BSM-2301/2351.

4. Touch the upper limit key to set the upper limit or touch the lower limit key to set the lower limit.

5. Touch the desired level on the setting bar. Touch the ▲ or ▼ key to adjust the setting.

   If the upper limit is set to a value above the maximum or the lower limit is set to a value below the minimum, the alarm is set to OFF.

6. Repeat steps 3 to 5 to change other parameter alarm settings.



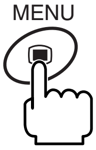
7. Press the HOME key on the front panel to return to the monitoring screen.

Setting All Vital Signs Alarms to a Preset Pattern (Alarm Master)

For fast and easy alarm setup, a group of alarm items can be set all together to one group of preset settings. This is called an alarm master. This is useful, for example, if there are typical alarm settings at your hospital, or you have certain alarm settings for certain patients.

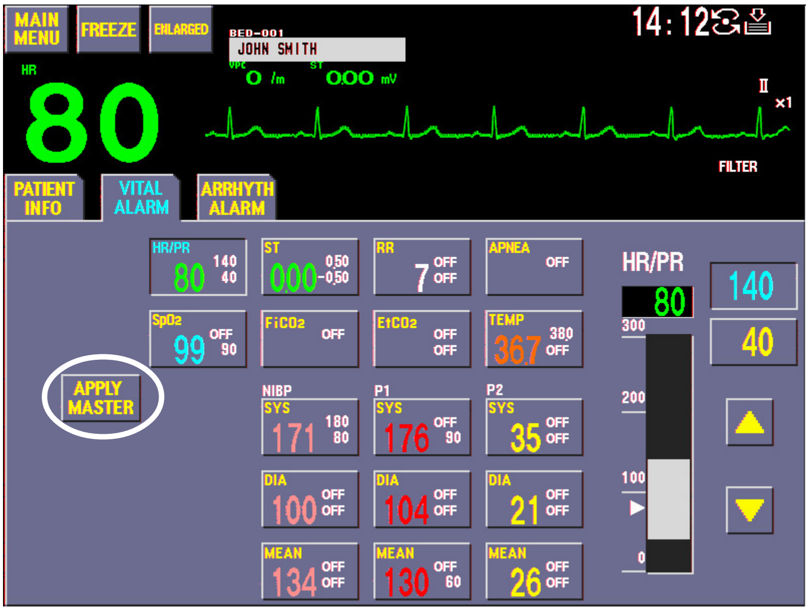
You can also change individual alarm settings, as described in previous pages, after setting all alarms with an alarm master.

To change the individual settings in an alarm master, refer to “Changing the Settings” in Section 3.

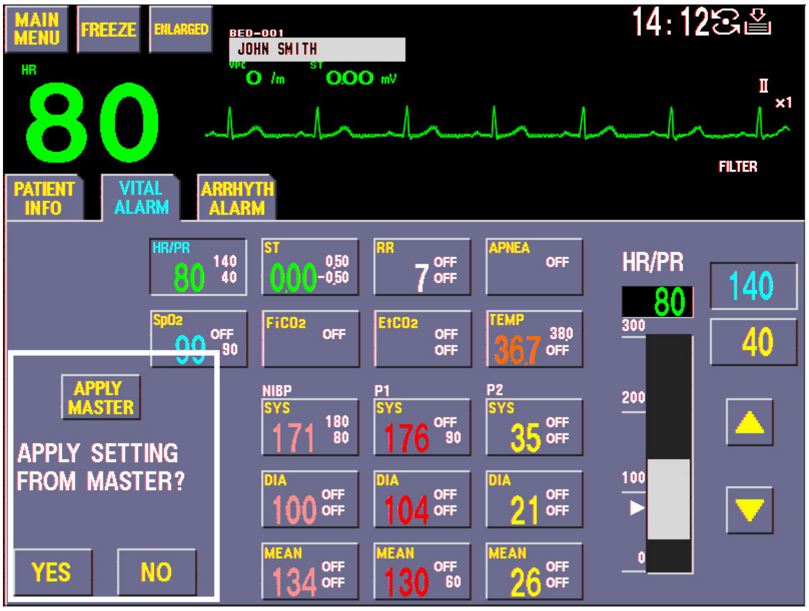


1. Press the MENU key on the front panel. The MENU window appears.

2. Touch the “VITAL ALARM” key. The VITAL ALARM window appears.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
14:12
HR
80
VPC
0 /m
ST
0.00 mV
II
×1
FILTER
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
HR/PR 80 140 40
ST 0.00 0.50 -0.50
RR 7 OFF OFF
APNEA OFF
SpO2 99 OFF 90
FiCO2 OFF
EtCO2 OFF OFF
TEMP 36.7 38.0 OFF
APPLY MASTER
NIBP SYS 171 180 80
DIA 100 OFF OFF
MEAN 134 OFF OFF
P1 SYS 176 OFF 90
DIA 104 OFF OFF
MEAN 130 OFF 60
P2 SYS 35 OFF OFF
DIA 21 OFF OFF
MEAN 26 OFF OFF
HR/PR
80
140
40
300
200
100
0

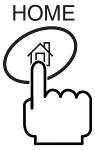
3. Touch the “APPLY MASTER” key. The “APPLY SETTING FROM MASTER?” message appears.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
14:12
HR
80
VPC
0 /m
ST
0.00 mV
II
×1
FILTER
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
HR/PR
80
140
40
ST
0.00
0.50
-0.50
RR
7
OFF
OFF
APNEA
OFF
SpO2
99
OFF
90
FiCO2
OFF
EtCO2
OFF
OFF
TEMP
36.7
38.0
OFF
APPLY MASTER
NIBP
SYS
171
180
80
P1
SYS
176
OFF
90
P2
SYS
35
OFF
OFF
DIA
100
OFF
OFF
DIA
104
OFF
OFF
DIA
21
OFF
OFF
MEAN
134
OFF
OFF
MEAN
130
OFF
60
MEAN
26
OFF
OFF
YES
NO
HR/PR
80
300
200
100
0
140
40

APPLY SETTING FROM MASTER?

4. Touch the “YES” key to change all settings to the value set on the ALARM MASTER of the SYSTEM SETUP screen.

   Touch the “NO” key to cancel changing the alarm settings to the alarm master setting.



5. Press the HOME key on the front panel to return to the monitoring screen.

Setting Arrhythmia Alarms Individually

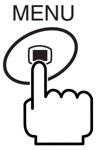
For details about arrhythmia monitoring, refer to “Monitoring Arrhythmia” in Section 10.

WARNING

For arrhythmia monitoring, set ARRHYTHMIA ANALYSIS on the ECG OTHER SETTING window to ON. Otherwise, there is no sound or indication for arrhythmia alarms.

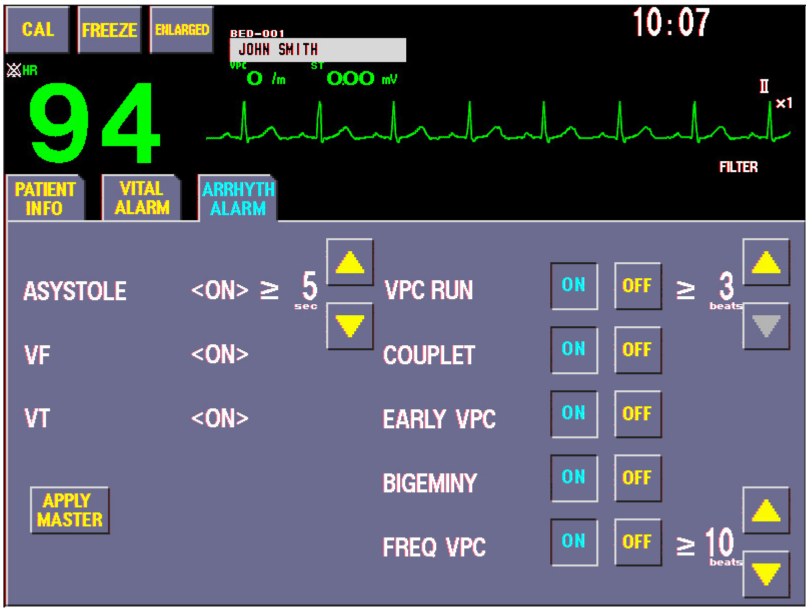
CAUTION

When the alarm is turned OFF for an arrhythmia, there will be no alarm for that arrhythmia type. There is no message or mark to indicate that a certain arrhythmia alarm is turned off, therefore, take care when turning off an arrhythmia alarm.



1. Press the MENU key on the front panel. The MENU window appears.

2. Touch the “ARRHYTH ALARM” key. The ARRHYTH ALARM window appears.



ASYSTOLE <ON> ≥ 5 sec

VF <ON>

VT <ON>

VPC RUN ON OFF ≥ 3 beats

COUPLET ON OFF

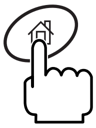
EARLY VPC ON OFF

BIGEMINY ON OFF

FREQ VPC ON OFF ≥ 10 beats

3. Touch the “ON” or “OFF” key for each arrhythmia type to set it on or off. ASYSTOLE, VF and VT are fixed to ON.

4. For “ASYSTOLE”, “VPC RUN” and “FREQ VPC”, set the detecting condition with the ▲ or ▼ key.



5. Press the HOME key on the front panel to return to the monitoring screen.

Setting All Arrhythmia Alarms to a Preset Pattern (Alarm Master)

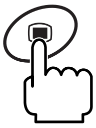
For fast and easy alarm setup, a group of alarm items can be set all together to one group of preset settings. This is called an alarm master. This is useful, for example, if there are typical alarm settings at your hospital, or you have certain alarm settings for certain patients.

You can also change individual alarm settings, as described in previous pages, after setting all alarms with an alarm master.

To change the individual settings in an alarm master, refer to “Changing the Settings” in Section 3.

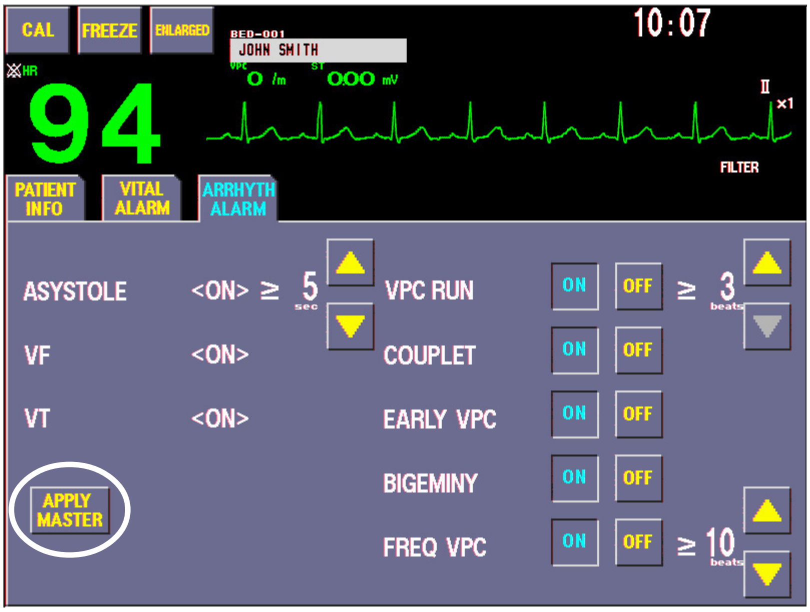
WARNING

For arrhythmia monitoring, set ARRHYTHMIA ANALYSIS on the ECG OTHER SETTING window to ON. Otherwise, there is no sound or indication for arrhythmia alarms.



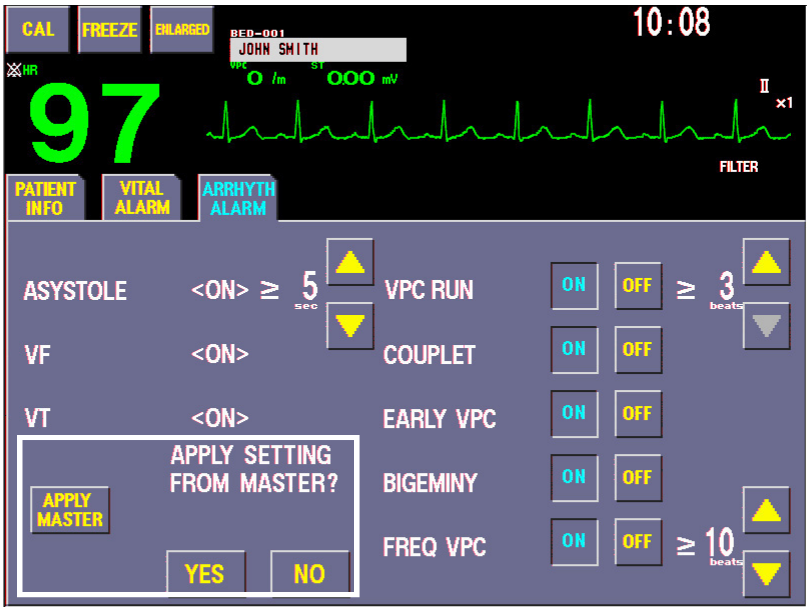
1. Press the MENU key on the front panel. The MENU window appears.

2. Touch the “ARRHYTH ALARM” key. The ARRHYTH ALARM window appears.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
10:07
HR
94
VPC 0 /m
ST 0.00 mV
II
×1
FILTER
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
APPLY MASTER

ASYSTOLE <ON> ≥ 5 sec
VF <ON>
VT <ON>
VPC RUN ON OFF ≥ 3 beats
COUPLET ON OFF
EARLY VPC ON OFF
BIGEMINY ON OFF
FREQ VPC ON OFF ≥ 10 beats

3. Touch the “APPLY MASTER” key. The “APPLY SETTING FROM MASTER?” message appears.

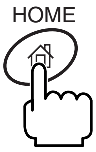

CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
10:08
HR
97
VPC 0 /m
ST 0.00 mV
II
×1
FILTER
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
APPLY MASTER
YES
NO

APPLY SETTING FROM MASTER?

ASYSTOLE <ON> ≥ 5 sec
VF <ON>
VT <ON>
VPC RUN ON OFF ≥ 3 beats
COUPLET ON OFF
EARLY VPC ON OFF
BIGEMINY ON OFF
FREQ VPC ON OFF ≥ 10 beats

4. Touch the “YES” key to change all settings to the values on the ALARM MASTER of the SYSTEM SETUP screen.

   Touch the “NO” key to not change the alarm settings to the alarm master settings.



5. Press the HOME key on the front panel to return to the monitoring screen.

Section 7 Review Windows

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General

You can review saved data on the following review windows.

- Trend window: Displays a trendgraph of the past 24 hours.
- List window: Displays vital sign data as a list. There is a periodic vital signs list and an NIBP list. Up to 120 files can be saved for each list type.
- Arrhythmia recall window: Displays arrhythmia waveforms of 4 seconds before and 4 seconds after the arrhythmia detection. Up to 16 files can be saved.
- Alarm history window: Displays the list of alarms. Up to 200 files can be saved.

Trend Window

Overview

On the TREND window, a selected parameter trendgraph of the past 1 to 24 hours is displayed with 1, 2, 4, 8 or 24 hour trend time. You can record the trendgraph on the optional recorder module.

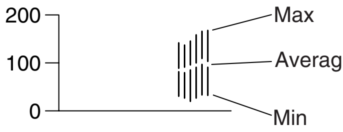
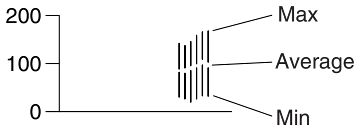
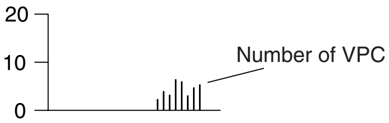
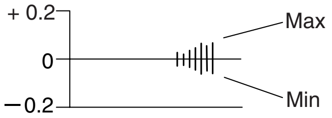
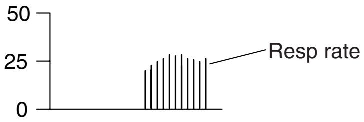
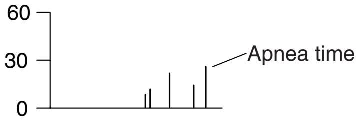
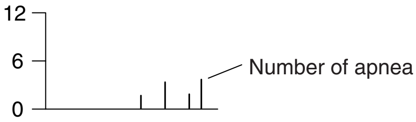
The maximum, mean and minimum values of all monitoring parameters are automatically acquired every 1 minute for the trendgraph. The acquired values are 1 minute averaged data. The frequency of data display depends on the selected trend time.

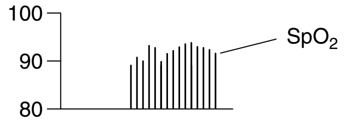
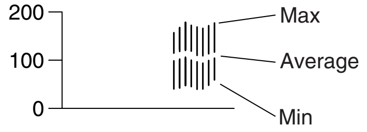
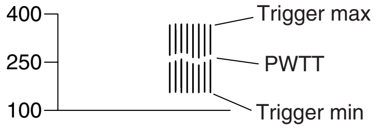
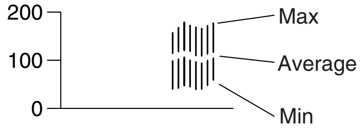
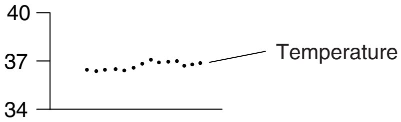
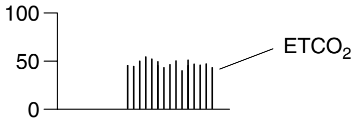
1, 2, 4 or 8 hours:	1 minute
24 hours:	3 minutes

NOTE

The stored data remains in memory for about 30 minutes after the monitor power is turned off. After 30 minutes, the stored data is lost.

The following table shows the available trend parameters, screen displays and scales.

Parameter	Description	Indication	Vertical Scale Range
HR	Heart rate (beats/min)		0-300 0-200 0-100
PR	Pulse rate (beats/min)		0-300 0-200 0-100
VPC	VPC rate (VPCs/min)		0-300 0-100 0-50 0-20
ST	ST level (mV, mm)		– 2.0 - +2.0 – 1.0 - +1.0 – 0.5 - +0.5 – 0.2 - +0.2 mV –20 - +20 –10 - +10 –5 - +5 –2.0 - +2.0 mm
RR	Respiration rate (breaths/min)		0-150 0-50
APNEA T	Apnea time (Total time in one data segment, in seconds)		0-180 0-120 0-60
APNEA F	Apnea frequency (Total number of apnea occurrences in one data segment)		0-12 0-6

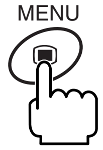
Parameter	Description	Indication	Vertical Scale Range	
SpO2	Saturated oxygen from pulse oximeter (%)		80-100 50-100 0-100	
NIBP	NIBP (mmHg, kPa)		0-300 0-200 0-100 mmHg	0-40.0 0-32.0 0-16.0 kPa
PWTT*	Pulse wave transit time (ms) Trigger time (ms)		100-400 100-300 200-400	
P1, P2**	IBP (mmHg, kPa)		0-300 0-200 0-160 0-100 0-50 0-20 mmHg	0-40.0 0-32.0 0-24.0 0-16.0 0-8.0 0-4.0 kPa
TEMP	Temperature (°C, °F)		0-40 20-40 34-40 °C	20-120 80-120 92-104 °F
ETCO2	End tidal CO2 partial pressure (mmHg, kPa)		0-80 0-40 0-20 mmHg	0-12.0 0-6.0 0-4.0 kPa
EVENT	Events (arrhythmia, OFF***)	———	———	

* PWTT is not available on BSM-2304.

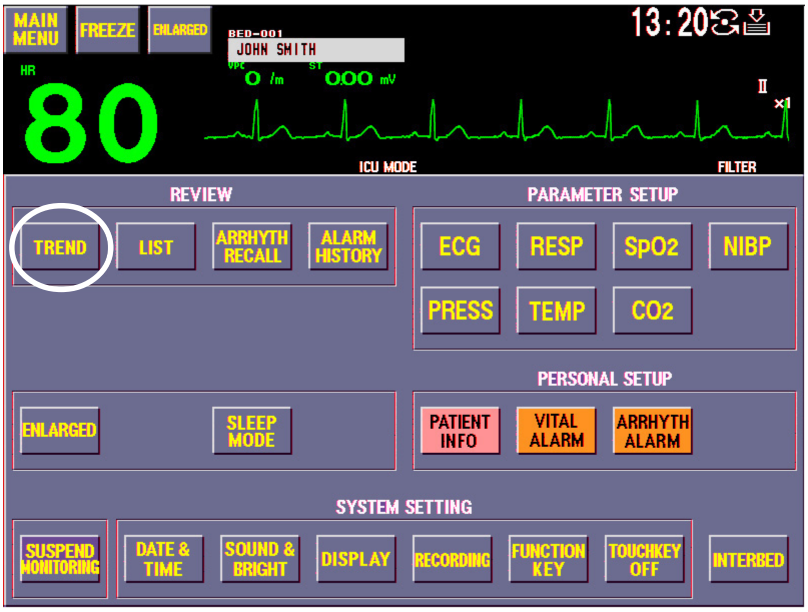
** P2 is not available on BSM-2301/2351.

*** OFF indicates monitoring pause and arrhythmia analysis off. When the arrhythmia analysis is turned off, an arrhythmia event trendgraph is not created.

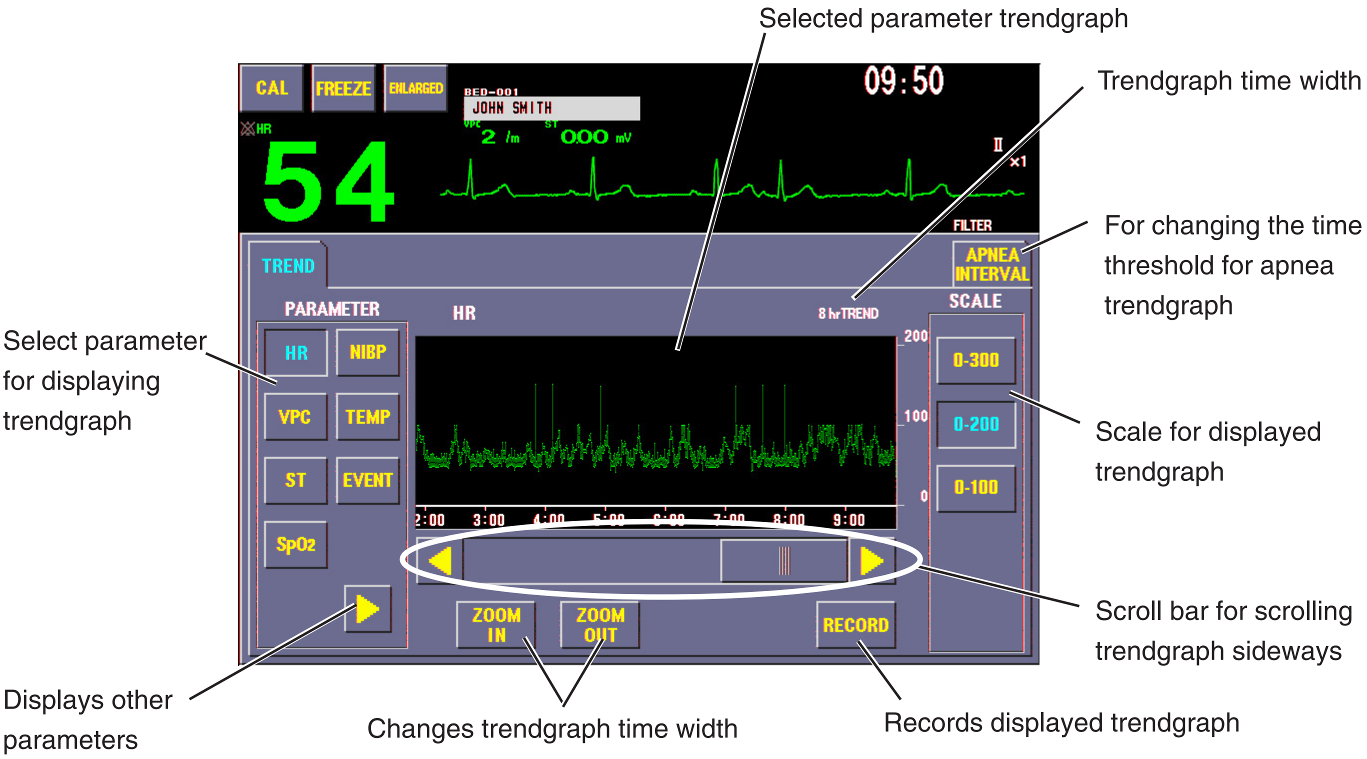
Displaying the TREND Window

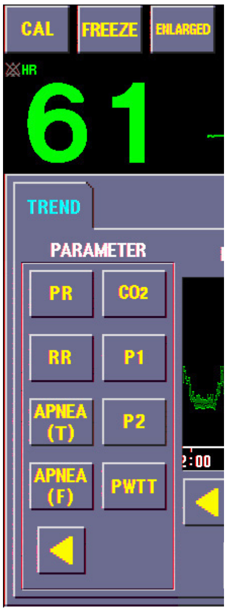


1. Press the MENU key on the front panel. The MENU window appears.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC
0 /m
ST
0.00 mV
II
×1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

2. Touch the “TREND” key to display the TREND window.


Selected parameter trendgraph
Trendgraph time width
For changing the time threshold for apnea trendgraph
Select parameter for displaying trendgraph
Scale for displayed trendgraph
Scroll bar for scrolling trendgraph sideways
Displays other parameters
Changes trendgraph time width
Records displayed trendgraph
CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
HR
54
VPC 2 /m
ST 000 mV
09:50
II
×1
FILTER
TREND
APNEA INTERVAL
PARAMETER
HR
8 hr TREND
SCALE
HR
NIBP
VPC
TEMP
ST
EVENT
SpO2
200
100
0
0-300
0-200
0-100
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
ZOOM IN
ZOOM OUT
RECORD


CAL
FREEZE
ENLARGED
HR
61
TREND
PARAMETER
PR
CO2
RR
P1
APNEA (T)
P2
APNEA (F)
PWTT
2:00

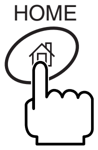
P2 is not available on BSM-2301.
PWTT is not available on BSM-2304.

3. From the PARAMETER box, select the parameter for displaying the trendgraph. To display other parameters, touch the ▶ key or ◀ key in the box.

4. To change the trendgraph time width, touch the “ZOOM IN” or “ZOOM OUT” key. Every time the key is touched, the time width changes as follows.

ZOOM OUT: 1 hour → 2 hour → 4 hour → 8 hour→ 24 hour
ZOOM IN: 24 hour → 8 hour → 4 hour → 2 hour → 1 hour

5. To change the trendgraph scale, select the appropriate scale from the SCALE box.

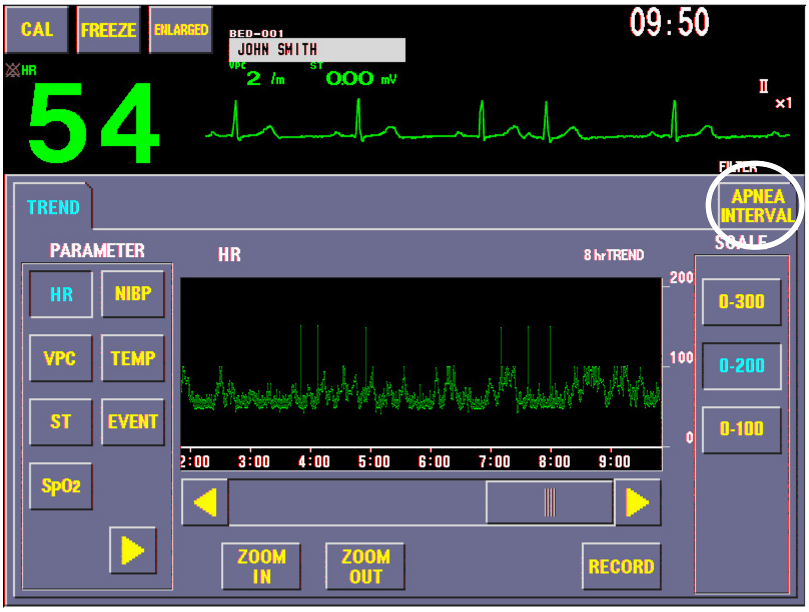


6. Press the HOME key on the front panel to return to the monitoring screen.

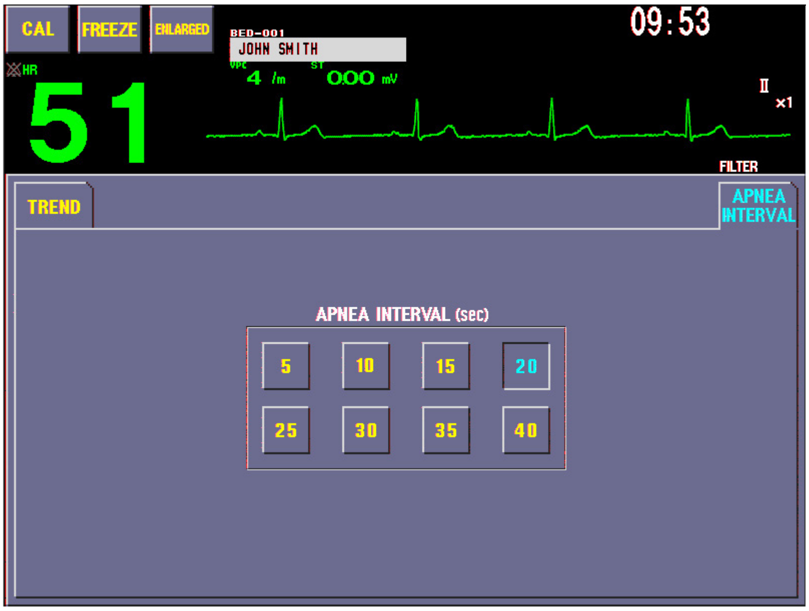
Changing the Time Threshold for Apnea Trendgraph

For the apnea trendgraph, the time threshold can be selected.

1. Touch the “APNEA INTERVAL” tab on the TREND window.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
09:50
HR
54
VPC 2 /m
ST 0.00 mV
II
×1
FILTER
TREND
APNEA INTERVAL
SCALE
PARAMETER
HR
NIBP
VPC
TEMP
ST
EVENT
SpO2
HR
8 hr TREND
200
100
0
0-300
0-200
0-100
2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00
ZOOM IN
ZOOM OUT
RECORD

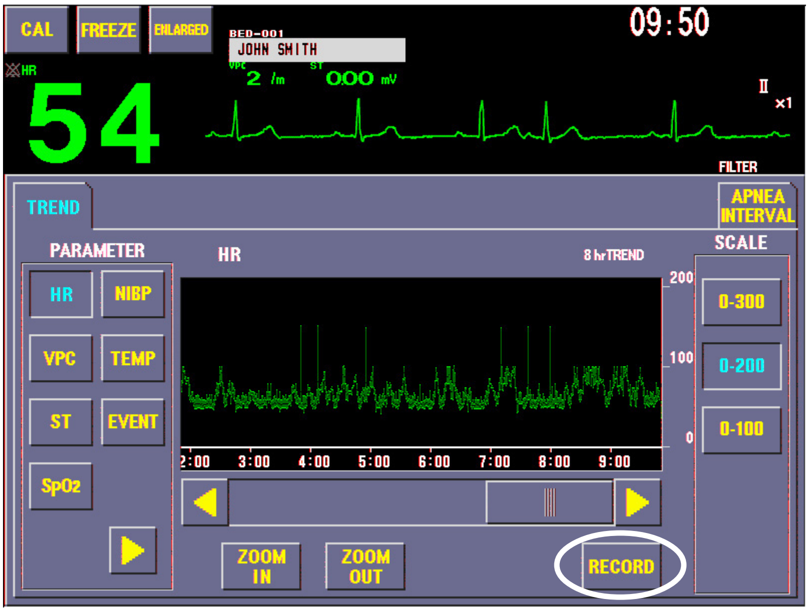
2. Select the desired time (in seconds) for the apnea trendgraph.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
09:53
HR
51
VPC 4 /m
ST 0.00 mV
II
×1
FILTER
TREND
APNEA INTERVAL
APNEA INTERVAL (sec)
5
10
15
20
25
30
35
40

Recording the Trendgraph

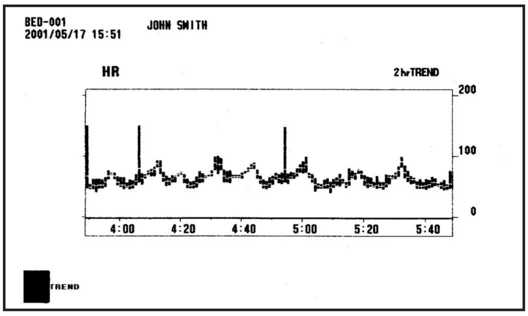
The trendgraph displayed on the TREND window can be recorded on the optional recorder module.

Display the trendgraph you want to record on the TREND window and touch the “RECORD” key.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
09:50
HR
54
VPC
2 /m
ST
0.00 mV
II
×1
FILTER
TREND
APNEA INTERVAL
PARAMETER
HR
8 hr TREND
SCALE
HR
NIBP
VPC
TEMP
ST
EVENT
SpO2
200
100
0
0-300
0-200
0-100
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
ZOOM IN
ZOOM OUT
RECORD

To stop recording the trendgraph, touch the “STOP REC” key on the screen or press the record key on the recorder module.

Recording example

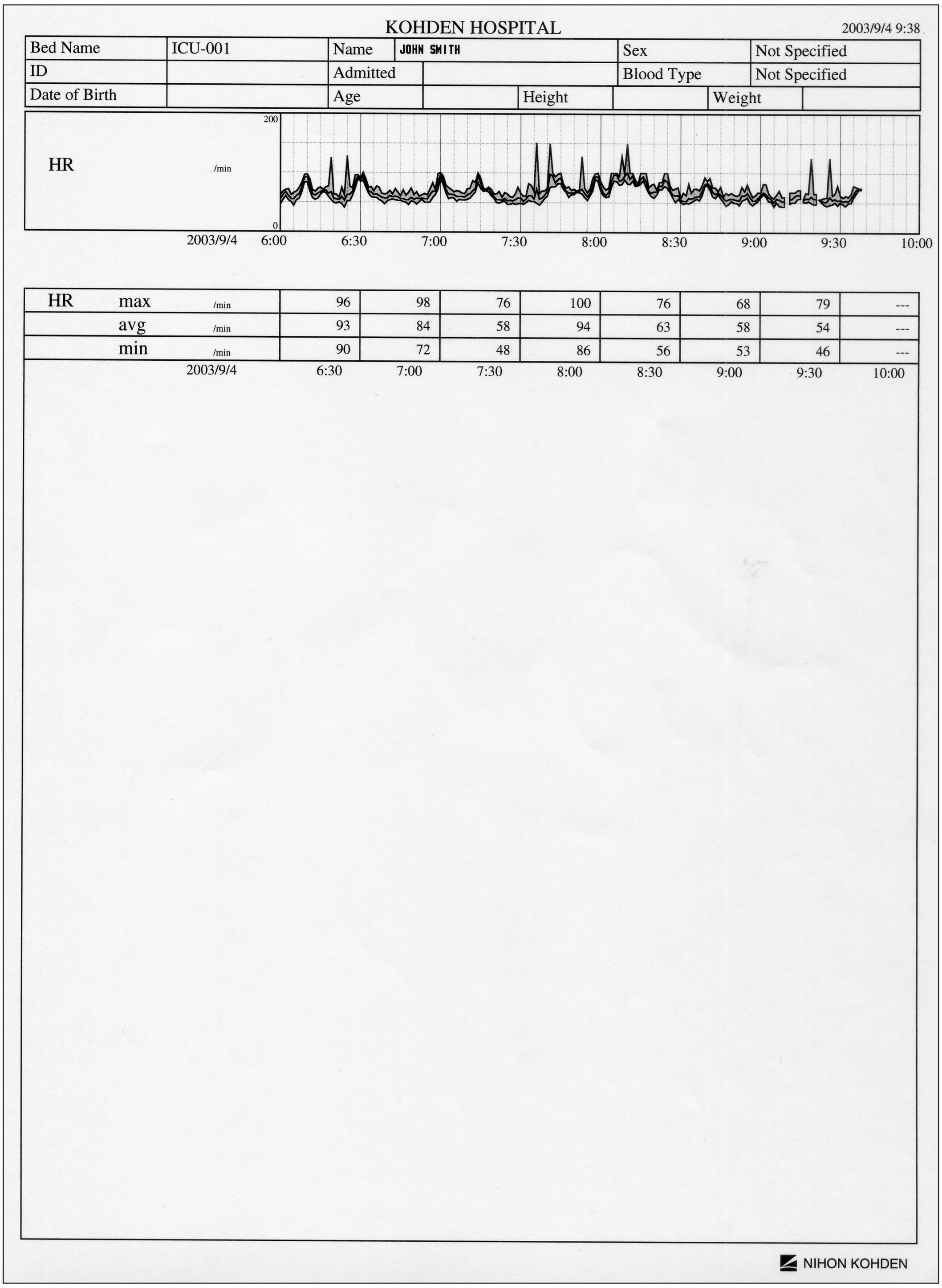


Printing the Trendgraph

The trendgraphs displayed on the TREND window can be printed when the monitor is connected to a network printer with a QI-111P network printer card.

Display the parameters you want to print on the TREND window and touch the “PRINT START” key.

Printing example



KOHDEN HOSPITAL

2003/9/4 9:38

Bed Name	ICU-001	Name	JOHN SMITH			Sex	Not Specified
ID		Admitted				Blood Type	Not Specified
Date of Birth		Age		Height		Weight	

HR
/min
200
0
2003/9/4
6:00
6:30
7:00
7:30
8:00
8:30
9:00
9:30
10:00

HR	max	/min	96	98	76	100	76	68	79	---
	avg	/min	93	84	58	94	63	58	54	---
	min	/min	90	72	48	86	56	53	46	---
		2003/9/4	6:30	7:00	7:30	8:00	8:30	9:00	9:30	10:00

NIHON KOHDEN

List Window

Overview

The LIST window lists all parameter data that is measured and saved at preset intervals. The list can be recorded on the optional recorder module. List parameters are:

- Heart rate
- Pulse rate
- VPC
- ST
- Respiration rate
- SpO_2
- NIBP
- P1, P2*
- TEMP
- CO_2

* P2 is not available on BSM-2301/2351.

You can select the parameters to be displayed on the LIST window on the LIST PARAM window.

There are two types of lists:

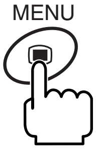
- Periodic vital signs list
  Data for all available parameters except for NIBP is automatically entered into the list at periodic sampling intervals. You can change the interval.
- NIBP list (vital signs list with NIBP measurements)
  Data for all parameters is automatically entered into the list every time NIBP is measured.

One window shows 8 measurements (one page). Each measurement appears on a separate line. Up to 120 measurements of the NIBP list and up to 120 measurements of the periodic vital signs list can be stored in memory. If more than 120 measurements are made, the oldest measurement is deleted.

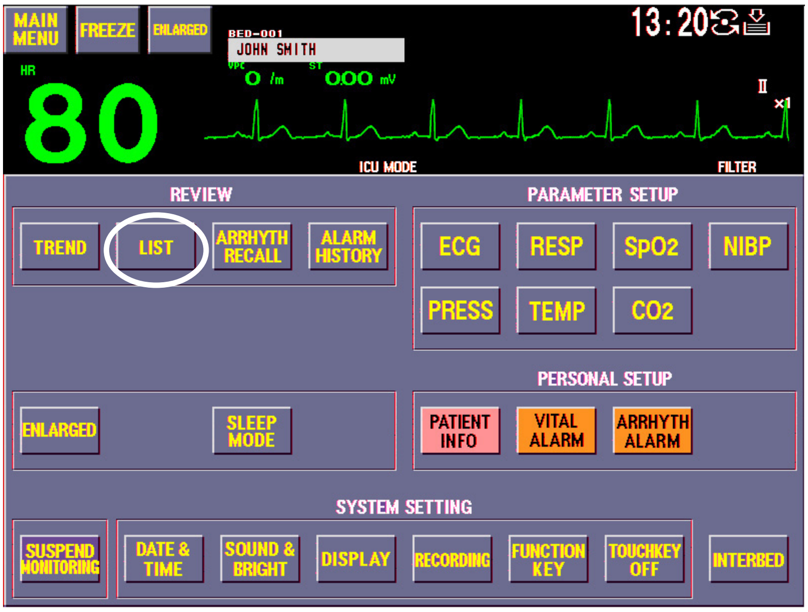
NOTE

The stored data remains in memory for about 30 minutes after the monitor power is turned off. After 30 minutes, the stored data is lost.

Displaying the LIST Window

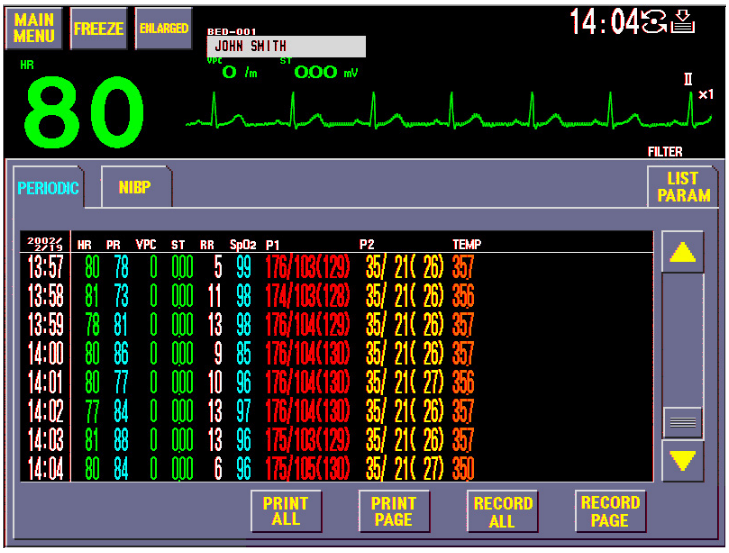


1. Press the MENU key on the front panel. The MENU window appears.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC 0 /m
ST 0.00 mV
II
×1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

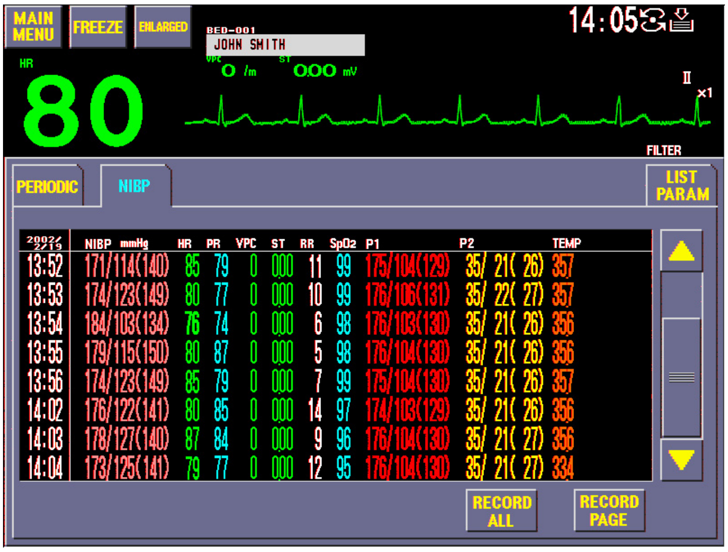
2. Touch the "LIST" key to display the LIST window.

Periodic List


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
14:04
HR
80
VPC 0 /m
ST 0.00 mV
II
×1
FILTER
PERIODIC
NIBP
LIST PARAM
PRINT ALL
PRINT PAGE
RECORD ALL
RECORD PAGE

2002/2/19	HR	PR	VPC	ST	RR	SpO2	P1	P2	TEMP
13:57	80	78	0	0.00	5	99	176/103(129)	35/ 21(26)	35.7
13:58	81	73	0	0.00	11	98	174/103(128)	35/ 21(26)	35.6
13:59	78	81	0	0.00	13	98	176/104(129)	35/ 21(26)	35.7
14:00	80	86	0	0.00	9	85	176/104(130)	35/ 21(26)	35.7
14:01	80	77	0	0.00	10	96	176/104(130)	35/ 21(27)	35.6
14:02	77	84	0	0.00	13	97	176/104(130)	35/ 21(26)	35.7
14:03	81	88	0	0.00	13	96	175/103(129)	35/ 21(26)	35.7
14:04	80	84	0	0.00	6	96	175/105(130)	35/ 21(27)	35.0

NIBP List


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
14:05
HR
80
VPC 0 /m
ST 0.00 mV
II
×1
FILTER
PERIODIC
NIBP
LIST PARAM
RECORD ALL
RECORD PAGE

2002/2/19	NIBP mmHg	HR	PR	VPC	ST	RR	SpO2	P1	P2	TEMP
13:52	171/114(140)	85	79	0	0.00	11	99	175/104(129)	35/ 21(26)	35.7
13:53	174/123(149)	80	77	0	0.00	10	99	176/106(131)	35/ 22(27)	35.7
13:54	184/103(134)	76	74	0	0.00	6	98	176/103(130)	35/ 21(26)	35.6
13:55	179/115(150)	80	87	0	0.00	5	98	176/104(130)	35/ 21(26)	35.6
13:56	174/123(149)	85	79	0	0.00	7	99	175/104(130)	35/ 21(26)	35.7
14:02	176/122(141)	80	85	0	0.00	14	97	174/103(129)	35/ 21(26)	35.6
14:03	178/127(140)	87	84	0	0.00	9	96	176/104(130)	35/ 21(27)	35.6
14:04	173/125(141)	79	77	0	0.00	12	95	176/104(130)	35/ 21(27)	33.4

Touch the “PERIODIC” tab to display the periodic vital signs list.

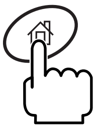
Touch the “NIBP” tab to display the NIBP list. “P” is displayed beside the NIBP data when NIBP is measured with PWTT (PWTT is only available on the BSM-2301/2351 monitor).

NOTE

The NIBP measurement time of the NIBP list on the LIST window is the time the measurement is completed.

If the list is larger than one page, use the vertical scroll bar to select the page of the list you want to review. A “NEWEST” message appears when the latest page is displayed. An “OLDEST” message appears when the oldest page is displayed.

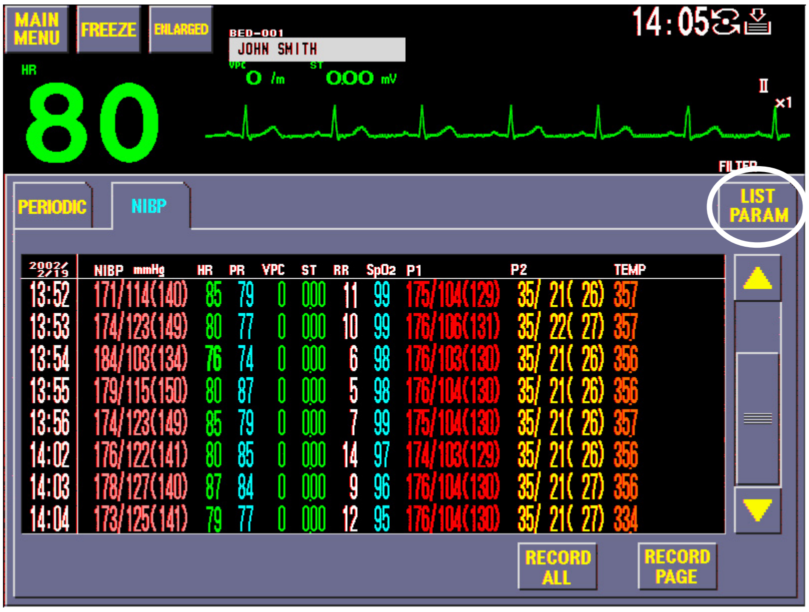
HOME



To return to the monitoring screen, press the HOME key on the front panel.

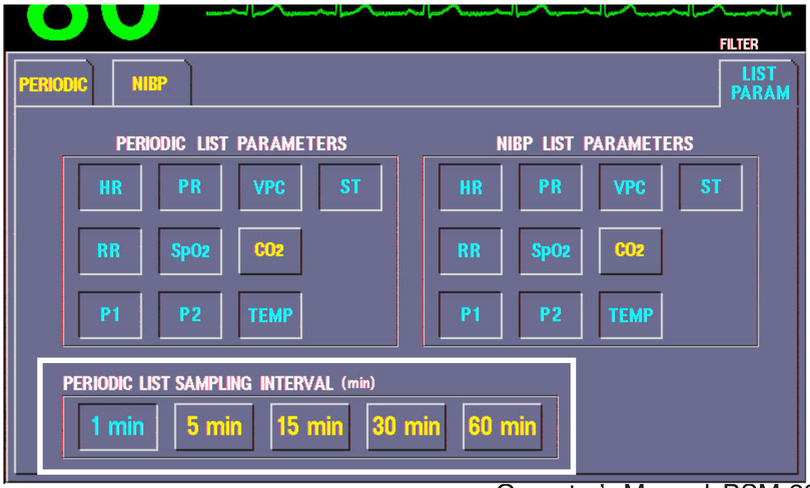
Setting the Data Sampling Interval for the Periodic Vital Signs List

1. Touch the “LIST PARAM” tab on the LIST window.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
14:05
HR
80
VPC
0 /m
ST
0.00 mV
II
x1
FILTER
PERIODIC
NIBP
LIST PARAM
RECORD ALL
RECORD PAGE

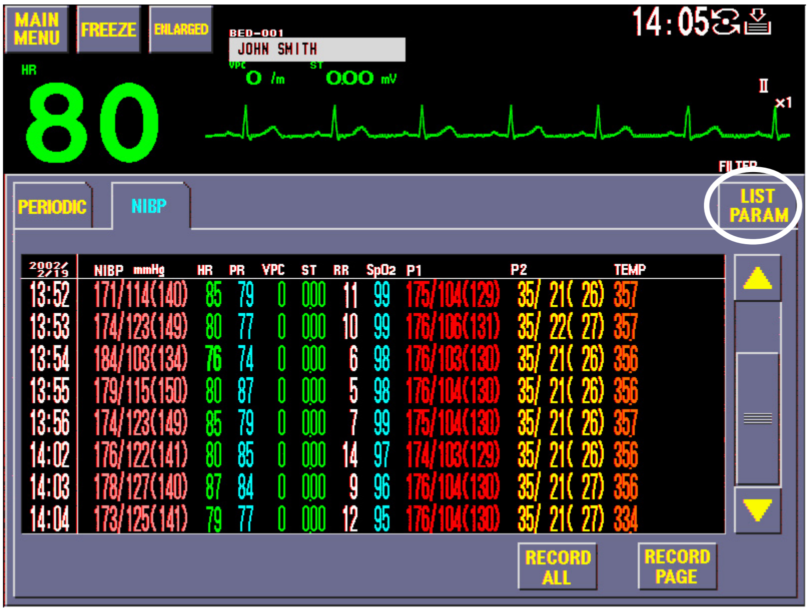
2002/2/19	NIBP mmHg	HR	PR	VPC	ST	RR	SpO2	P1	P2	TEMP
13:52	171/114(140)	85	79	0	0.00	11	99	175/104(129)	35/ 21(26)	35.7
13:53	174/123(149)	80	77	0	0.00	10	99	176/106(131)	35/ 22(27)	35.7
13:54	184/103(134)	76	74	0	0.00	6	98	176/103(130)	35/ 21(26)	35.6
13:55	179/115(150)	80	87	0	0.00	5	98	176/104(130)	35/ 21(26)	35.6
13:56	174/123(149)	85	79	0	0.00	7	99	175/104(130)	35/ 21(26)	35.7
14:02	176/122(141)	80	85	0	0.00	14	97	174/103(129)	35/ 21(26)	35.6
14:03	178/127(140)	87	84	0	0.00	9	96	176/104(130)	35/ 21(27)	35.6
14:04	173/125(141)	79	77	0	0.00	12	95	176/104(130)	35/ 21(27)	33.4

2. Select the desired time (minutes) key in the PERIODIC LIST SAMPLING INTERVAL box.


80
FILTER
PERIODIC
NIBP
LIST PARAM
PERIODIC LIST PARAMETERS
HR
PR
VPC
ST
RR
SpO2
CO2
P1
P2
TEMP
NIBP LIST PARAMETERS
HR
PR
VPC
ST
RR
SpO2
CO2
P1
P2
TEMP
PERIODIC LIST SAMPLING INTERVAL (min)
1 min
5 min
15 min
30 min
60 min

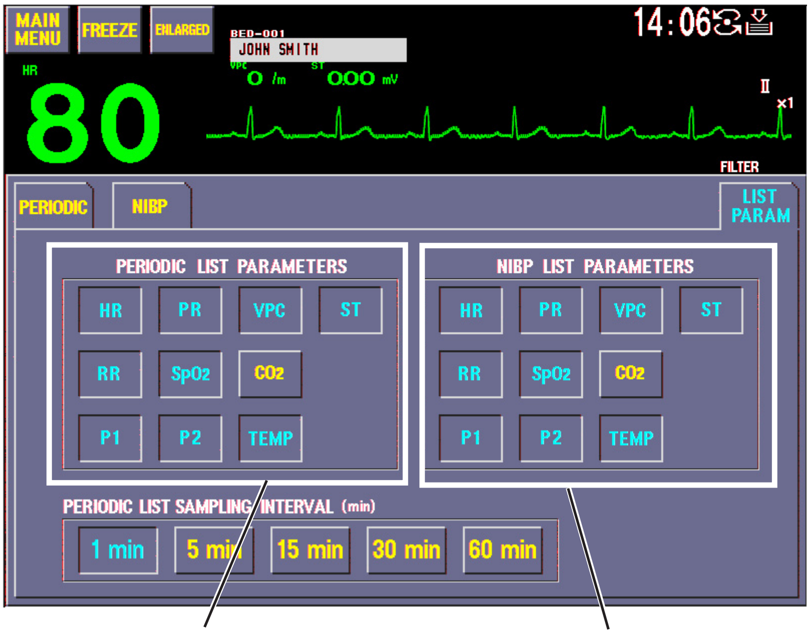
Selecting Parameters to be Displayed on the LIST Window

1. Touch the “LIST PARAM” tab on the LIST window.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
14:05
HR
80
VPC 0 /m
ST 0.00 mV
II
x1
FILTER
PERIODIC
NIBP
LIST PARAM
RECORD ALL
RECORD PAGE

2002/2/19	NIBP mmHg	HR	PR	VPC	ST	RR	SpO2	P1	P2	TEMP
13:52	171/114(140)	85	79	0	0.00	11	99	175/104(129)	35/ 21(26)	35.7
13:53	174/123(149)	80	77	0	0.00	10	99	176/106(131)	35/ 22(27)	35.7
13:54	184/103(134)	76	74	0	0.00	6	98	176/103(130)	35/ 21(26)	35.6
13:55	179/115(150)	80	87	0	0.00	5	98	176/104(130)	35/ 21(26)	35.6
13:56	174/123(149)	85	79	0	0.00	7	99	175/104(130)	35/ 21(26)	35.7
14:02	176/122(141)	80	85	0	0.00	14	97	174/103(129)	35/ 21(26)	35.6
14:03	178/127(140)	87	84	0	0.00	9	96	176/104(130)	35/ 21(27)	35.6
14:04	173/125(141)	79	77	0	0.00	12	95	176/104(130)	35/ 21(27)	33.4

2. Select the parameters you want to display on the LIST window.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
14:06
HR
80
VPC 0 /m
ST 0.00 mV
II
x1
FILTER
PERIODIC
NIBP
LIST PARAM
PERIODIC LIST PARAMETERS
HR
PR
VPC
ST
RR
SpO2
CO2
P1
P2
TEMP
NIBP LIST PARAMETERS
HR
PR
VPC
ST
RR
SpO2
CO2
P1
P2
TEMP
PERIODIC LIST SAMPLING INTERVAL (min)
1 min
5 min
15 min
30 min
60 min

For the periodic vital sign list

For the NIBP list

P2 is not available on BSM-2301/2351.

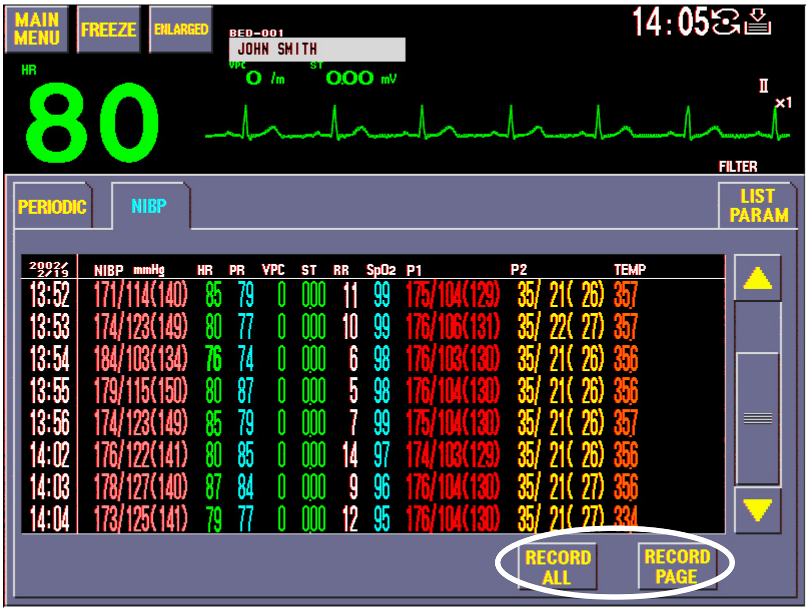
3. Touch the “PERIODIC” or “NIBP” tab to return to the LIST window. The selected parameters are displayed.

Recording the List

The displayed list can be recorded on the optional recorder module.

To record only the data displayed on the LIST window, touch the “RECORD PAGE” key.

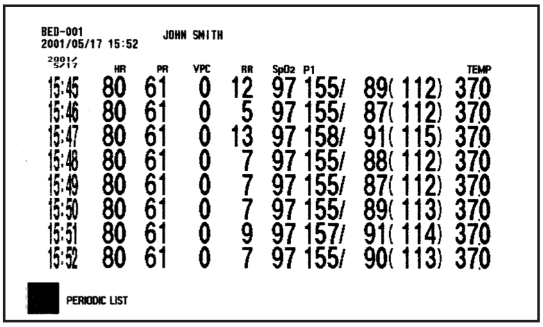
To record all stored list data, touch the “RECORD ALL” key.



2002/2/19	NIBP mmHg	HR	PR	VPC	ST	RR	SpO2	P1	P2	TEMP
13:52	171/114(140)	85	79	0	0.00	11	99	175/104(129)	35/ 21(26)	35.7
13:53	174/123(149)	80	77	0	0.00	10	99	176/106(131)	35/ 22(27)	35.7
13:54	184/103(134)	76	74	0	0.00	6	98	176/103(130)	35/ 21(26)	35.6
13:55	179/115(150)	80	87	0	0.00	5	98	176/104(130)	35/ 21(26)	35.6
13:56	174/123(149)	85	79	0	0.00	7	99	175/104(130)	35/ 21(26)	35.7
14:02	176/122(141)	80	85	0	0.00	14	97	174/103(129)	35/ 21(26)	35.6
14:03	178/127(140)	87	84	0	0.00	9	96	176/104(130)	35/ 21(27)	35.6
14:04	173/125(141)	79	77	0	0.00	12	95	176/104(130)	35/ 21(27)	33.4

To stop recording the list, touch the “STOP REC” key on the screen or press the ⎙ record key on the recorder module.

Recording example



BED-001
2001/05/17 15:52
JOHN SMITH

2001/5/17	HR	PR	VPC	RR	SpO2	P1	TEMP
15:45	80	61	0	12	97	155/ 89(112)	37.0
15:46	80	61	0	5	97	155/ 87(112)	37.0
15:47	80	61	0	13	97	158/ 91(115)	37.0
15:48	80	61	0	7	97	155/ 88(112)	37.0
15:49	80	61	0	7	97	155/ 87(112)	37.0
15:50	80	61	0	7	97	155/ 89(113)	37.0
15:51	80	61	0	9	97	157/ 91(114)	37.0
15:52	80	61	0	7	97	155/ 90(113)	37.0

PERIODIC LIST

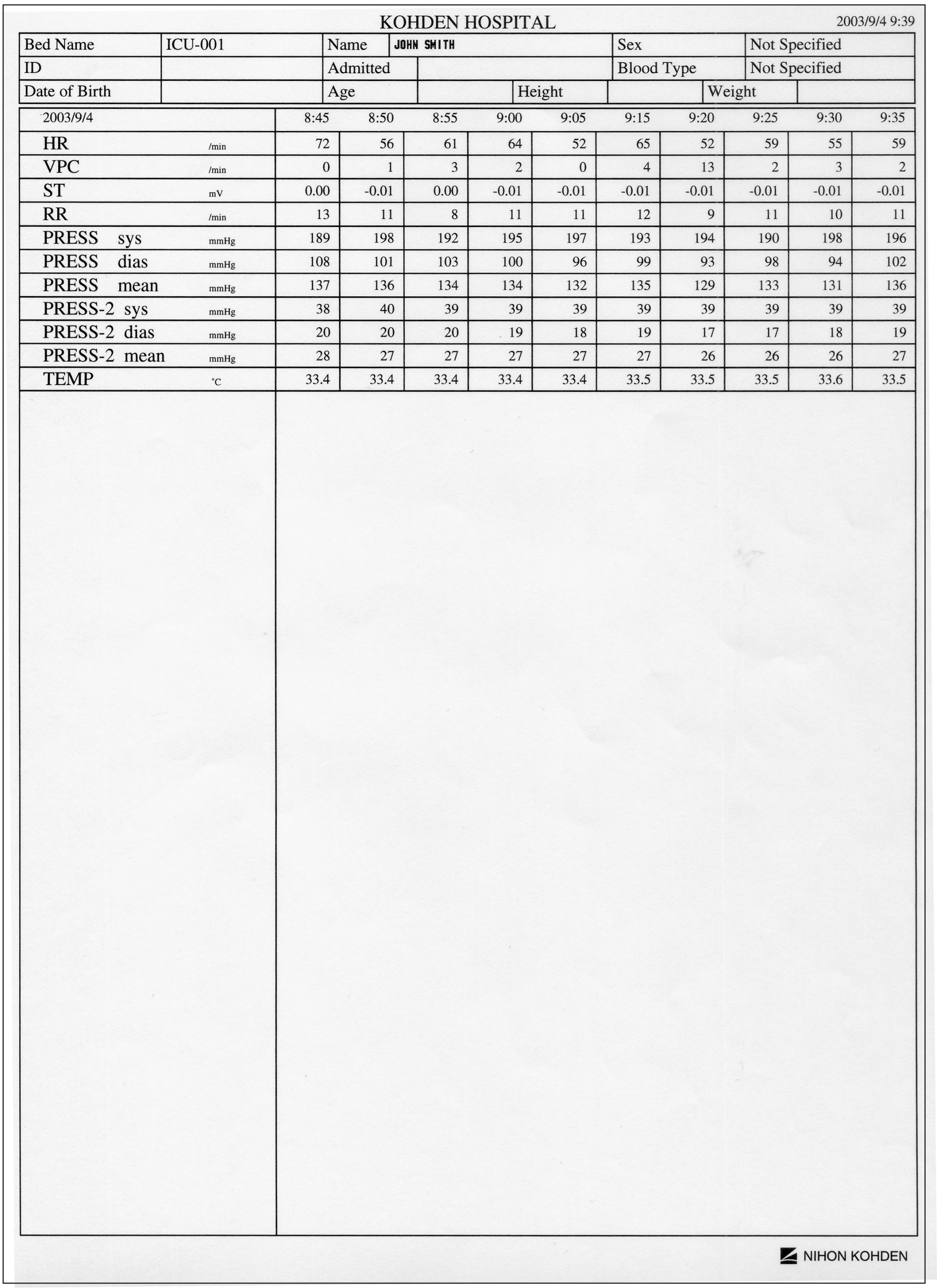
Printing the List

The list data can be printed when the monitor is connected to a network printer with a QI-111P network printer card.

To print only the data displayed on the LIST window, touch the “PRINT PAGE” key.

To print all stored list data, touch the “PRINT ALL” key.

Printing example



KOHDEN HOSPITAL

2003/9/4 9:39

Bed Name	ICU-001	Name	JOHN SMITH		Sex	Not Specified	
ID		Admitted			Blood Type	Not Specified	
Date of Birth		Age		Height		Weight	

2003/9/4		8:45	8:50	8:55	9:00	9:05	9:15	9:20	9:25	9:30	9:35
HR	/min	72	56	61	64	52	65	52	59	55	59
VPC	/min	0	1	3	2	0	4	13	2	3	2
ST	mV	0.00	-0.01	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
RR	/min	13	11	8	11	11	12	9	11	10	11
PRESS sys	mmHg	189	198	192	195	197	193	194	190	198	196
PRESS dias	mmHg	108	101	103	100	96	99	93	98	94	102
PRESS mean	mmHg	137	136	134	134	132	135	129	133	131	136
PRESS-2 sys	mmHg	38	40	39	39	39	39	39	39	39	39
PRESS-2 dias	mmHg	20	20	20	19	18	19	17	17	18	19
PRESS-2 mean	mmHg	28	27	27	27	27	27	26	26	26	27
TEMP	°C	33.4	33.4	33.4	33.4	33.4	33.5	33.5	33.5	33.6	33.5

NIHON KOHDEN

Arrhythmia Recall Window

Overview

An ECG waveform of 4 seconds before and 4 seconds after the arrhythmia detection is saved as an arrhythmia recall file. Up to 16 files can be created. When more than 16 files are created, the oldest file is automatically deleted.

To create arrhythmia recall files:
- ARRHYTHMIA ANALYSIS on the ECG window must be set to ON. Refer to "Monitoring Arrhythmia" in Section 10.
- The type of arrhythmias you want to save as files must be selected on the ARRHYTH RECALL window. Refer to the "Selecting the Arrhythmia Types to be Saved as a Recall File" section.

NOTE

The stored data remains in memory for about 30 minutes after the monitor power is turned off. After 30 minutes, the stored data is lost.

Arrhythmia List

The arrhythmias are listed in the priority of highest to lowest. When several arrhythmias occur at the same time, only the arrhythmia of the highest priority is saved as the recall file.

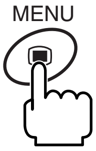
Arrhythmia	Meaning
ASYSTOLE	Cardiac arrest
VF	Ventricular fibrillation
VT	Ventricular tachycardia
VPC RUN	VPC short run
COUPLET	VPC couplet
EARLY VPC	Early VPC
BIGEMINY	Ventricular bigeminy
TACHYCARDIA	Exceeding the upper heart rate limit
BRADYCARDIA	Dropping below the lower heart rate limit
VPC	Ventricular premature contraction

Arrhythmia Waveform Annotation

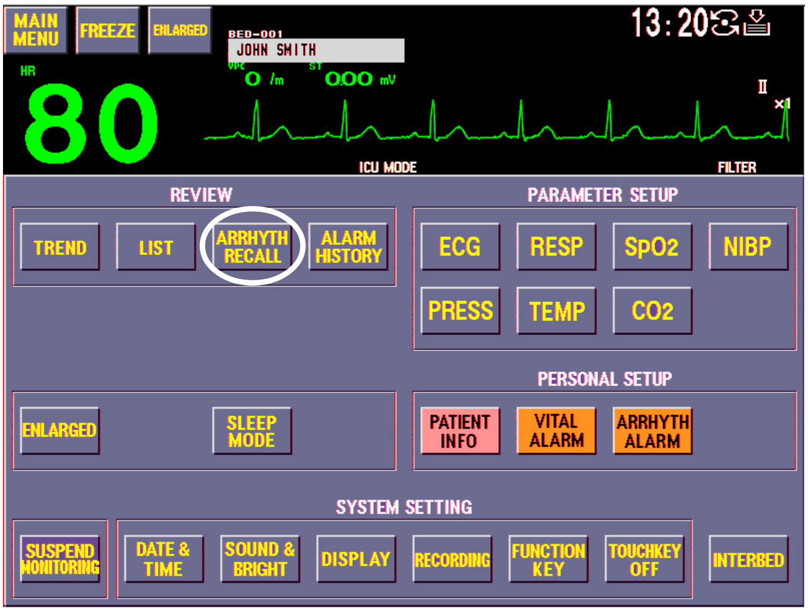
Each beat of a stored arrhythmia waveform is automatically classified and annotated as follows.

Beat Annotation	Description
N	Normal QRS complex (equal to the dominant QRS)
S	Supraventricular premature contraction
V	Ventricular premature contraction
E	Early VPC. VPC with a time interval from the preceding normal QRS complex that is shorter than approx. one-third of the normal R-R interval.
A	Abnormal beat (e.g. ventricular escaped beat)
P	Paced QRS
?	Impossible to classify or during learning.
—	Impossible to classify due to noise interference.

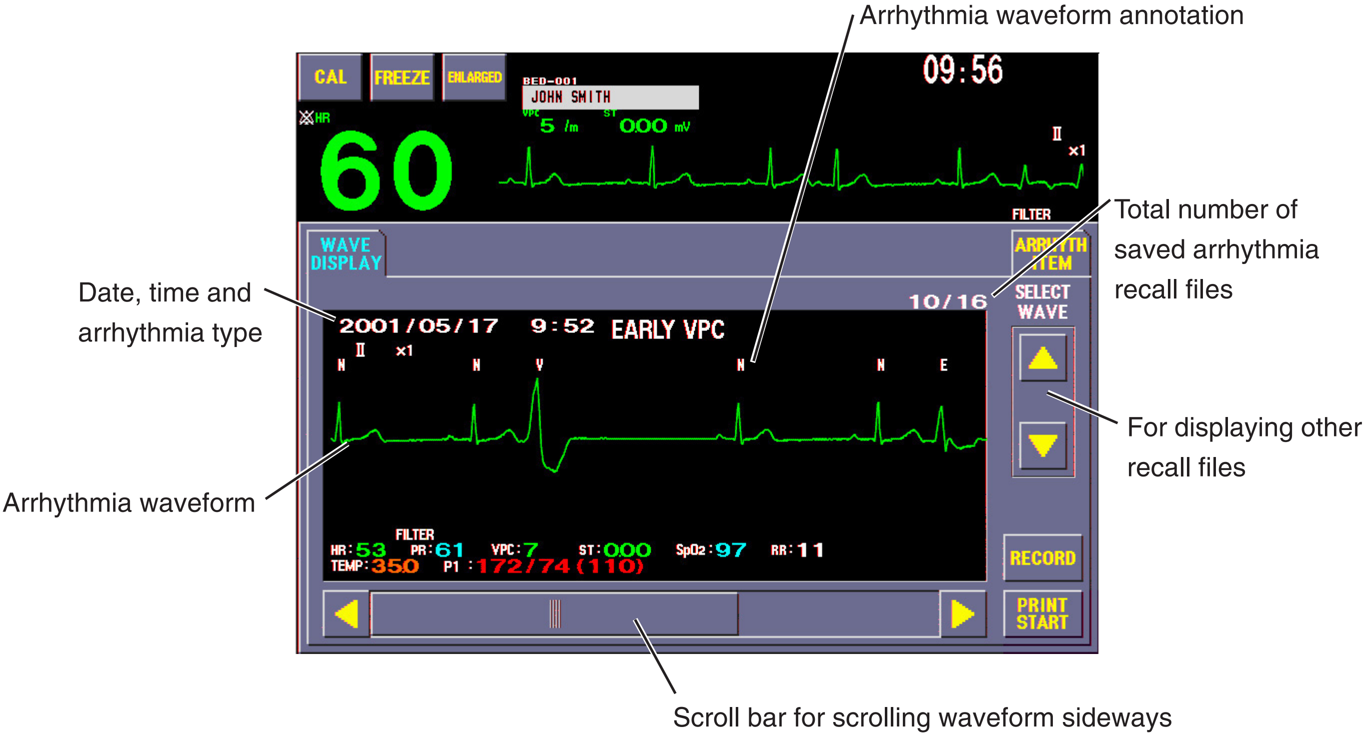
Displaying the Arrhythmia Recall Window



1. Press the MENU key on the front panel. The MENU window appears.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC
0 /m
ST
0.00 mV
II
×1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

2. Touch the “ARRHYTH RECALL” key to display the Arrhythmia Recall window.


Arrhythmia waveform annotation
Total number of saved arrhythmia recall files
Date, time and arrhythmia type
For displaying other recall files
Arrhythmia waveform
Scroll bar for scrolling waveform sideways
CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
09:56
HR
60
VPC 5 /m
ST 0.00 mV
II ×1
FILTER
WAVE DISPLAY
ARRHYTH ITEM
SELECT WAVE
10/16
2001/05/17 9:52 EARLY VPC
II ×1
N N V N N E
HR:53 PR:61 VPC:7 ST:0.00 SpO2:97 RR:11
TEMP:35.0 P1:172/74(110)
RECORD
PRINT START

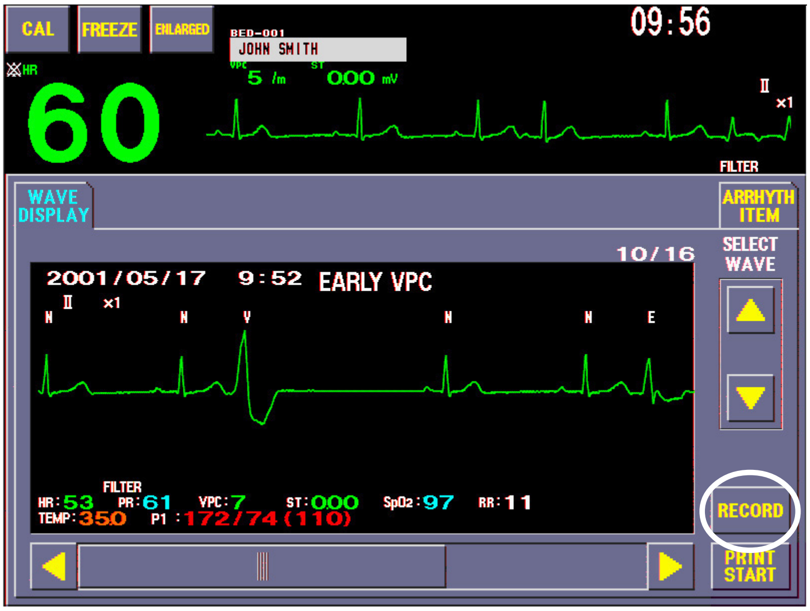
When there is no recall file, the “NO DATA” message is displayed.

To display other recall files, touch the ▲ or ▼ key in the SELECT WAVE box.

Recording the Arrhythmia Recall Waveform

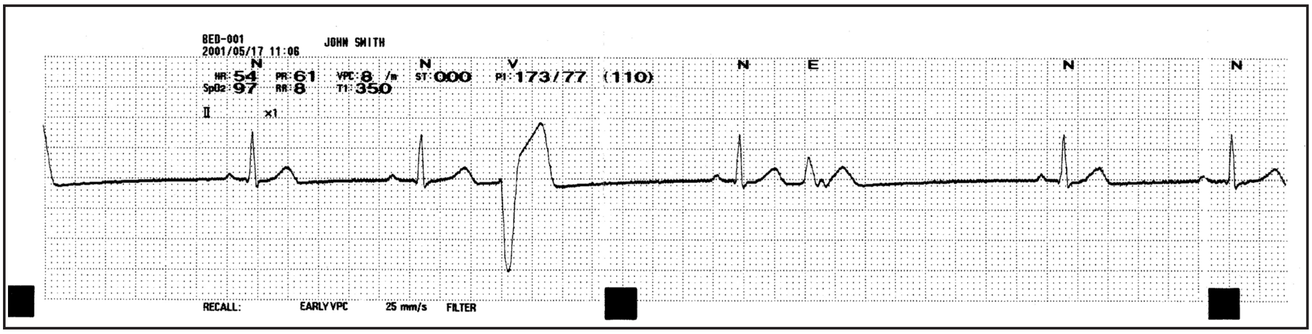
The displayed arrhythmia waveform can be recorded on the optional recorder module.

Display the arrhythmia waveform you want to record on the Arrhythmia Recall window and touch the “RECORD” key.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
09:56
HR
60
VPC 5 /m
ST 0.00 mV
II ×1
FILTER
WAVE DISPLAY
ARRHYTH ITEM
SELECT WAVE
10/16
2001/05/17 9:52 EARLY VPC
II ×1
N N V N N E
HR:53 PR:61 VPC:7 ST:0.00 SpO2:97 RR:11
TEMP:35.0 P1:172/74(110)
RECORD
PRINT START

To stop recording the waveform, touch the “STOP REC” key on the screen or press the ▣ record key on the recorder module.

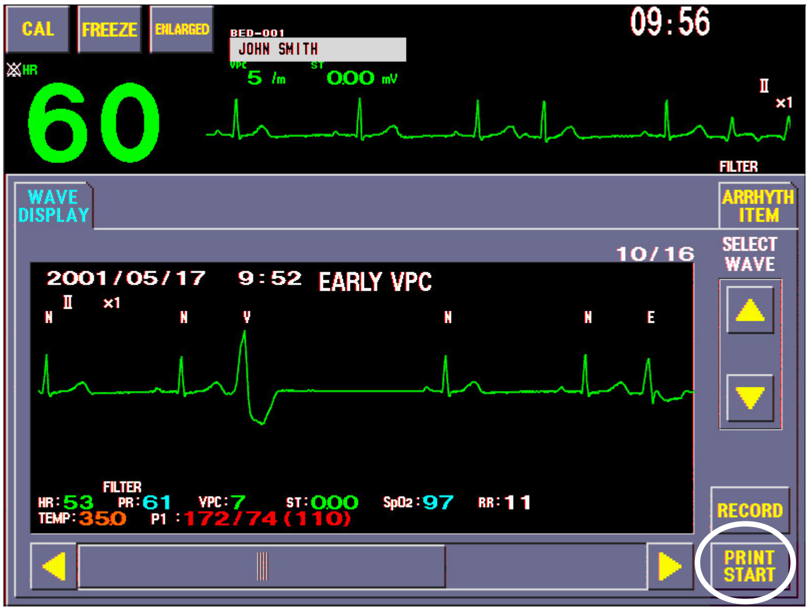
Recording example



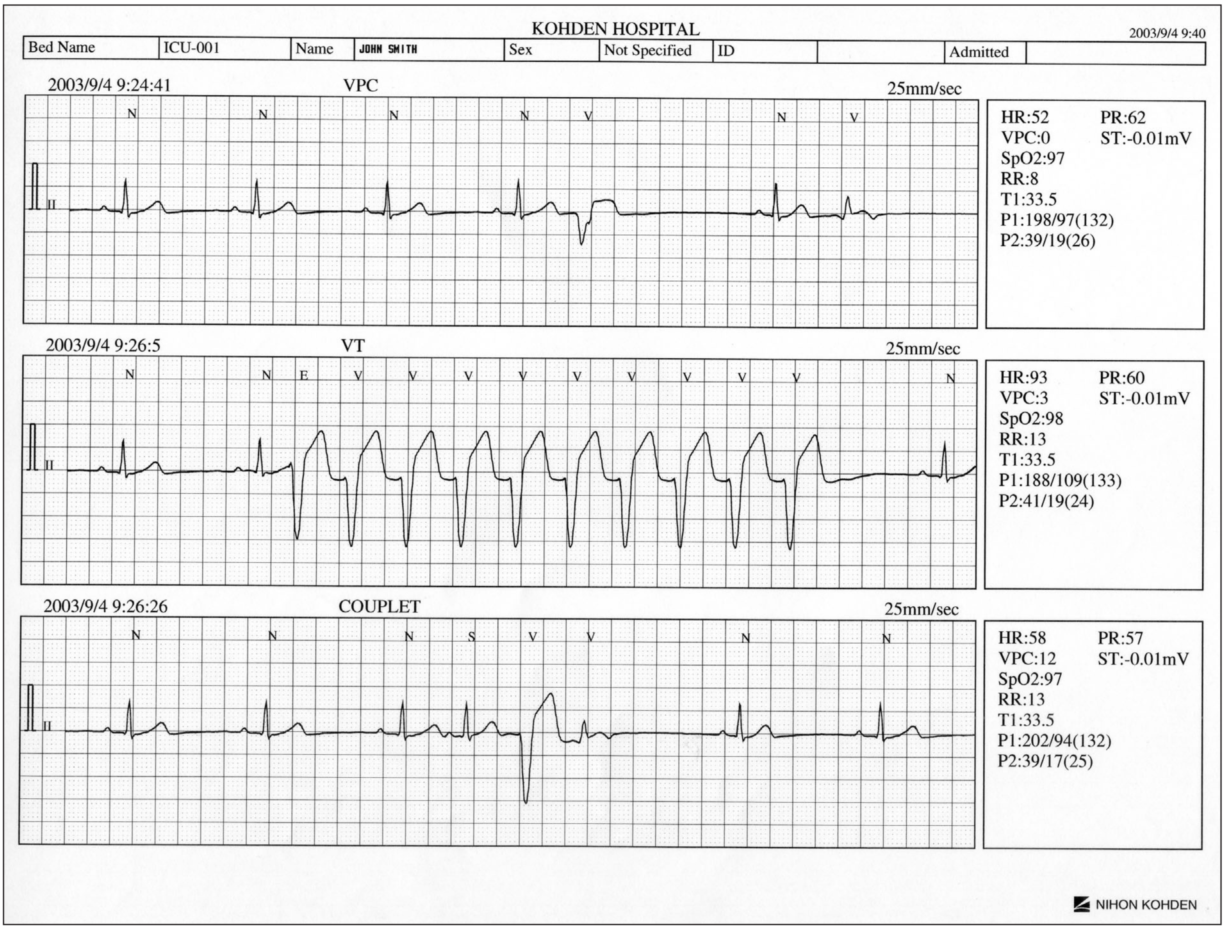
Printing the Arrhythmia Recall Waveform

The arrhythmia waveform of the selected arrhythmia recall file can be printed when the monitor is connected to a network printer with a QI-111P network printer card. The arrhythmia waveforms one before and one after the selected file are also printed.

To print, touch the “PRINT START” key.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
09:56
HR
60
VPC
5 /m
ST
000 mV
II
×1
FILTER
WAVE DISPLAY
ARRHYTH ITEM
10/16
SELECT WAVE
2001/05/17 9:52 EARLY VPC
II ×1
N
N
V
N
N
E
FILTER
HR:53
PR:61
VPC:7
ST:000
SpO2:97
RR:11
TEMP:350
P1:172/74(110)
RECORD
PRINT START

Printing Example



KOHDEN HOSPITAL

2003/9/4 9:40

Bed Name	ICU-001	Name	JOHN SMITH	Sex	Not Specified	ID		Admitted	

2003/9/4 9:24:41 VPC 25mm/sec

HR:52 PR:62
VPC:0 ST:-0.01mV
SpO2:97
RR:8
T1:33.5
P1:198/97(132)
P2:39/19(26)

2003/9/4 9:26:5 VT 25mm/sec

HR:93 PR:60
VPC:3 ST:-0.01mV
SpO2:98
RR:13
T1:33.5
P1:188/109(133)
P2:41/19(24)

2003/9/4 9:26:26 COUPLET 25mm/sec

HR:58 PR:57
VPC:12 ST:-0.01mV
SpO2:97
RR:13
T1:33.5
P1:202/94(132)
P2:39/17(25)

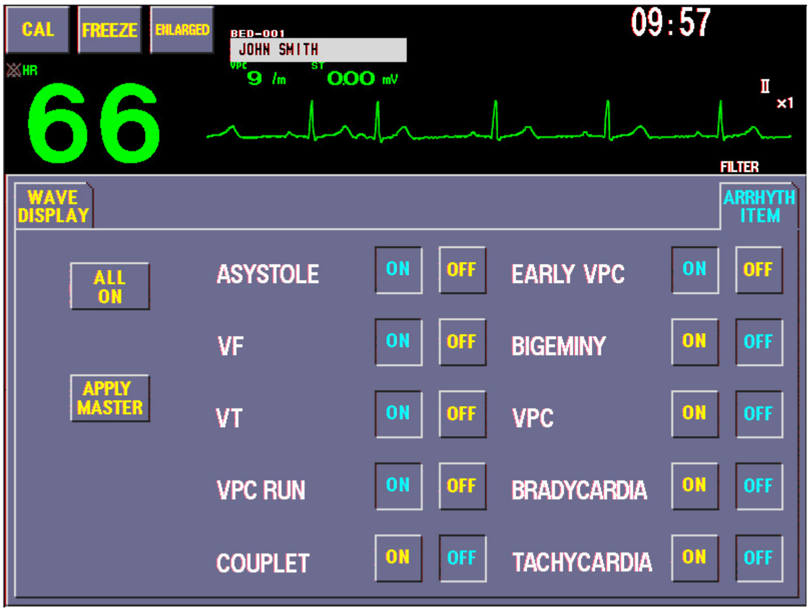
N N N N V N V
II
N N E V V V V V V V V V N
II
N N N S V V N N
II
NIHON KOHDEN

Selecting the Arrhythmia Types to be Saved as a Recall File

Select the arrhythmia types to create files for. These settings can be set all together to one group of preset settings called an arrhythmia recall master. The arrhythmia recall master is set on the SYSTEM SETUP screen. Refer to Section 3.

1. Touch the “ARRHYTH ITEM” tab on the Arrhythmia Recall window.

2. Select “ON” or “OFF” for each arrhythmia item. When “ALL ON” is selected, all arrhythmia types are saved. When the “ALL ON” key is touched again, all arrhythmia types are set to OFF.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
09:57
HR
66
VPC
9 /m
ST
0.00 mV
II
×1
FILTER
WAVE DISPLAY
ARRHYTH ITEM
ALL ON
APPLY MASTER
ASYSTOLE
ON
OFF
VF
ON
OFF
VT
ON
OFF
VPC RUN
ON
OFF
COUPLET
ON
OFF
EARLY VPC
ON
OFF
BIGEMINY
ON
OFF
VPC
ON
OFF
BRADYCARDIA
ON
OFF
TACHYCARDIA
ON
OFF

To set using the arrhythmia recall master:

1. Touch the “APPLY MASTER” key. The “APPLY SETTINGS FROM MASTER?” message appears.

2. Touch the “YES” key to change all settings to the settings on the ARRHYTHMIA RECALL MASTER of the SYSTEM SETUP screen.

   Touch the “NO” key to cancel changing the settings.

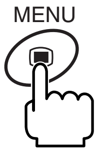
Alarm History Window

Alarms can be listed on the ALARM HISTORY window. Up to 200 data can be saved and up to 8 data can be displayed on the ALARM HISTORY window. The alarm history is created when any alarm occurs.

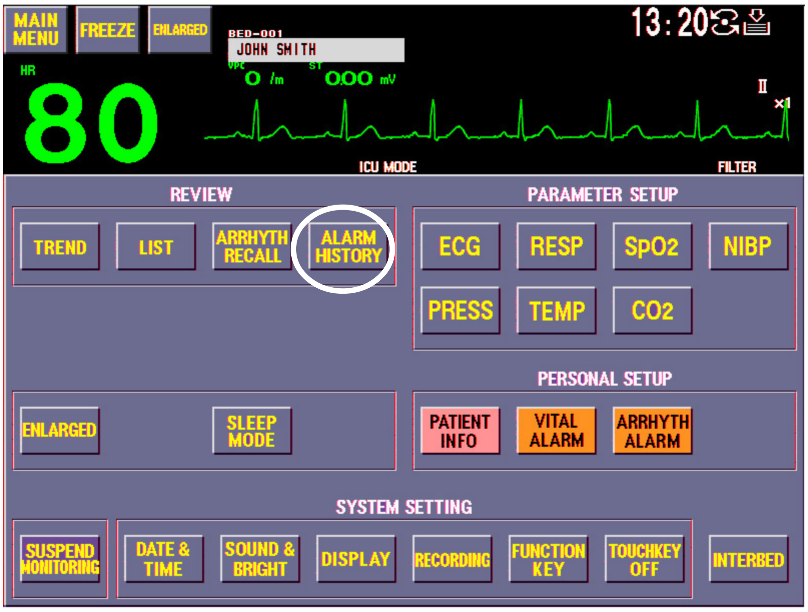
NOTE

The stored data remains in memory for about 30 minutes after the power is turned off. After 30 minutes, the stored data is lost.

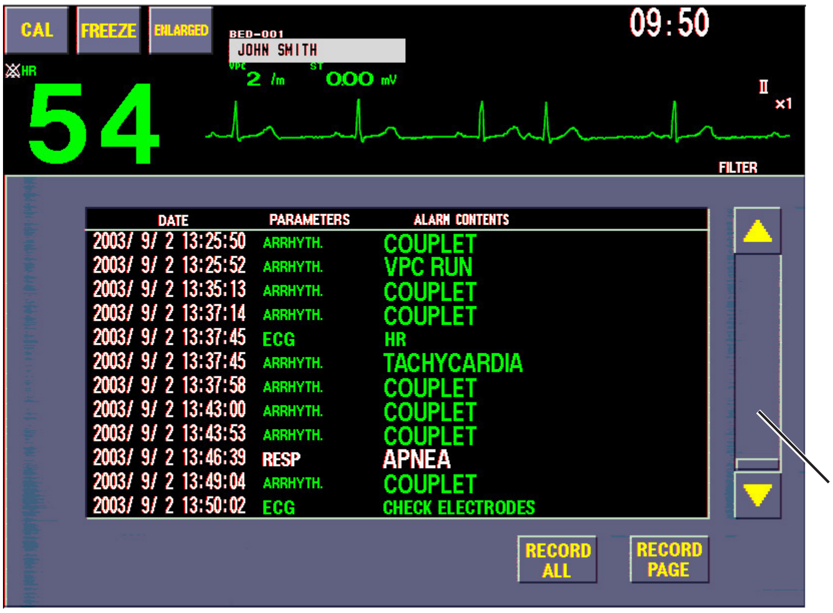
Displaying the ALARM HISTORY Window



1. Press the MENU key on the front panel. The MENU window appears.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC
0 /m
ST
0.00 mV
II
×1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
ENLARGED
SLEEP MODE
PERSONAL SETUP
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

2. Touch the “ALARM HISTORY” key to display the ALARM HISTORY window.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
HR
54
VPC
2 /m
ST
0.00 mV
09:50
II
×1
FILTER
RECORD ALL
RECORD PAGE

DATE	PARAMETERS	ALARM CONTENTS
2003/ 9/ 2 13:25:50	ARRHYTH.	COUPLET
2003/ 9/ 2 13:25:52	ARRHYTH.	VPC RUN
2003/ 9/ 2 13:35:13	ARRHYTH.	COUPLET
2003/ 9/ 2 13:37:14	ARRHYTH.	COUPLET
2003/ 9/ 2 13:37:45	ECG	HR
2003/ 9/ 2 13:37:45	ARRHYTH.	TACHYCARDIA
2003/ 9/ 2 13:37:58	ARRHYTH.	COUPLET
2003/ 9/ 2 13:43:00	ARRHYTH.	COUPLET
2003/ 9/ 2 13:43:53	ARRHYTH.	COUPLET
2003/ 9/ 2 13:46:39	RESP	APNEA
2003/ 9/ 2 13:49:04	ARRHYTH.	COUPLET
2003/ 9/ 2 13:50:02	ECG	CHECK ELECTRODES

Scroll bar for displaying other alarm history file

Recording the Alarm History Data

To record the displayed alarm history list, touch the "RECORD PAGE" key.

To record all alarm history list, touch the "RECORD ALL" key.

Section 8 Recording

Overview of Recording 8.1
  Recording Modes 8.2
    Manual Recording/Printing on the Monitoring Screen (Real Time/Delayed Recording) 8.3
    Manually Recording OCRG on the Monitoring Screen 8.3
    Manually Recording PWTT trendgraph on the Monitoring Screen 8.3
    Manually Recording/Printing on the Review Windows 8.3
    Periodic Recording 8.3
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Overview of Recording

A variety of waveforms and data can be recorded on the optional WS-231P recorder module.

When the bedside monitor is connected to a network printer with the optional QI-111P network printer card, real-time waveforms and data on the review windows can be printed. Refer to the “Printing on a Network Printer” section.

This section provides an overview of recording.

The “Changing the Recording Pattern” section explains how to change the recording pattern for all recordings except for the review data recordings.

The “Manually Recording Waveforms” section explains how to manually record waveforms at any time.

The “Setting Periodic Recording” section explains necessary settings for performing automatic periodic recording.

Some recording procedures are explained in other sections.

- To record trendgraphs, see Section 7.
- To record the vital signs list, see Section 7.
- To record arrhythmia recall files, see Section 7.
- For alarm recording, see Section 6.

To load recording paper, see “Preparing the Optional Recorder Module” in Section 2.

For what to do in case of trouble, see Section 17.

Recording Modes

The following recording modes are available.

Recording mode		Recorded data	Length/time of recorded data	Operations/conditions/ settings for recording	Printed annotation
Manual recording	Real time/ delayed* waveform recording	ECG and two other waveforms selected on the RECORDING window with vital sign data	Time set at MANUAL RECORD TIME on the SYSTEM SETUP screen	Record key on the recorder module is pressed	MANUAL
				Second and third parameters for waveform recording on the RECORDING window.	
	List recording	List on the window	Data displayed on the screen or all saved data	“RECORD PAGE” or “RECORD ALL” key on the LIST window is pressed	LIST
	Trend recording	Trendgraph on the window	---	“RECORD” key on the TREND window is pressed	TREND
	Arrhythmia recall recording	Arrhythmia waveform on the window	8 seconds	“RECORD” key on the ARRHYTH RECALL window is pressed	RECALL
	Alarm history recording	Alarm history on the window	List displayed on the window or all saved list	“RECORD” or “RECORD ALL” key on the ALARM HISTORY window is pressed	ALARM HISTORY
	OCRG recording	OCRG on the monitoring screen	2 pages	“OCRG RECORD” function key is pressed	OCRG
	PWTT recording	PWTT trendgraph on the monitoring screen	30 minutes	“PWTT RECORD” function key is pressed	PWTT
Automatic recording	Vital signs alarm recording	ECG and two other waveforms selected on the RECORDING window and vital sign data at an alarm occurrence	From 8 seconds before to 12 seconds after alarm occurrence	ALARM RECORDING on the RECORDING window must be set to ON	ALARM
				Alarm for vital signs parameter must be turned on	
				Second and third parameters for waveform recording on the RECORDING window.	
	Arrhythmia alarm recording	ECG and two other waveforms selected on the RECORDING window and vital sign data at an alarm occurrence	From 8 seconds before to 12 seconds after alarm occurrence	ALARM RECORDING on the RECORDING window must be set to ON	
				Alarm for arrhythmias must be turned on	
				ARRHYTHMIA ANALYSIS on the ECG window must be set to ON	
				Second and third parameters for waveform recording on the RECORDING window.	
	Periodic recording	ECG and two other waveforms selected on the RECORDING window with numerical data	10 seconds	PERIODIC REC INTERVAL on the RECORDING window must be set to a time interval	TIMER
				Second and third parameters for waveform recording on the RECORDING window.	
		OCRG on the monitoring screen	2 pages	PERIODIC REC INTERVAL on the RECORDING window must be set to either 5(OCRG) or 15(OCRG)	OCRG
		PWTT trendgraph on the monitoring screen	30 minutes	PERIODIC REC INTERVAL on the RECORDING window must be set to 30(PWTT)	PWTT

* Real time or delayed recording can be selected on the SYSTEM SETUP screen. Refer to Section 3.

Manual Recording/Printing on the Monitoring Screen (Real Time/ Delayed Recording)

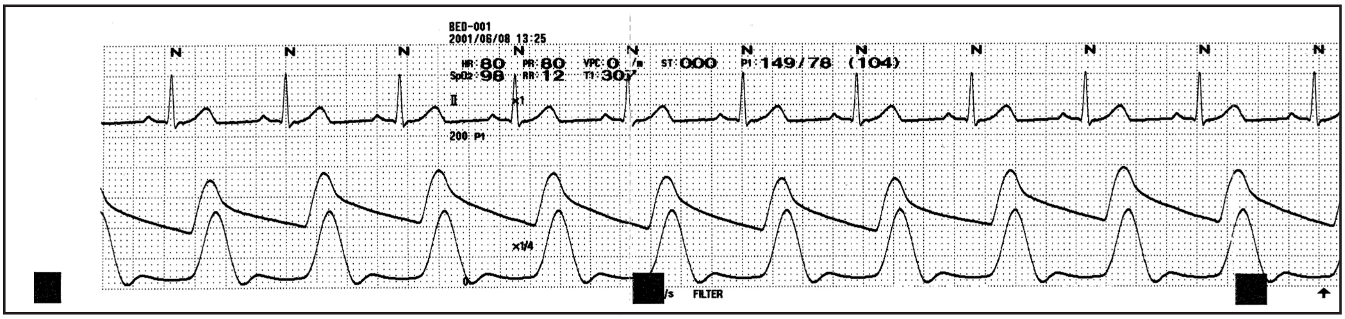
ECG and two waveforms selected on the RECORDING window are recorded. For details, refer to the "Manually Recording Waveforms" section.

With recorder: Recorded on the optional recorder whenever the ⌇ record key on the front panel is pressed.

No recorder: Not available

Bedside monitor connected to a network printer with QI-111P:
Printed on the network printer whenever the "PRINT" key on the upper left corner of the screen is touched. To assign PRINT to one of the function keys, refer to Section 4.

Recording example



Manually Recording OCRG on the Monitoring Screen

OCRG on the monitoring screen can be recorded whenever the "OCRG RECORD " function key on the upper left corner of the screen is touched. To assign OCRG RECORD to one of the function keys, refer to Section 4.

Manually Recording PWTT trendgraph on the Monitoring Screen

PWTT trendgraph on the monitoring screen can be recorded whenever the "PWTT RECORD " function key on the upper left corner of the screen is touched. To assign PWTT RECORD to one of the function keys, refer to Section 4.

Manually Recording/Printing on the Review Windows

Waveforms and data displayed on the review window can be recorded. For details, refer to Section 7.

With recorder: Recorded on the optional recorder when the "RECORD" key on the review window is pressed.

No recorder: Not available

Bedside monitor connected to a network printer with QI-111P:
Printed on the network printer when the "PRINT START" key on the TREND and ARRHYTH RECALL window or the "PRINT PAGE" or "PRINT ALL" key on the LIST window is touched.

Periodic Recording

You can select one of the three types of recording data for periodic recording.

- ECG and up to two waveforms with numerical data:
  The 10 second ECG and up to two waveforms selected on the RECORDING window and vital signs data are recorded automatically at the set interval.

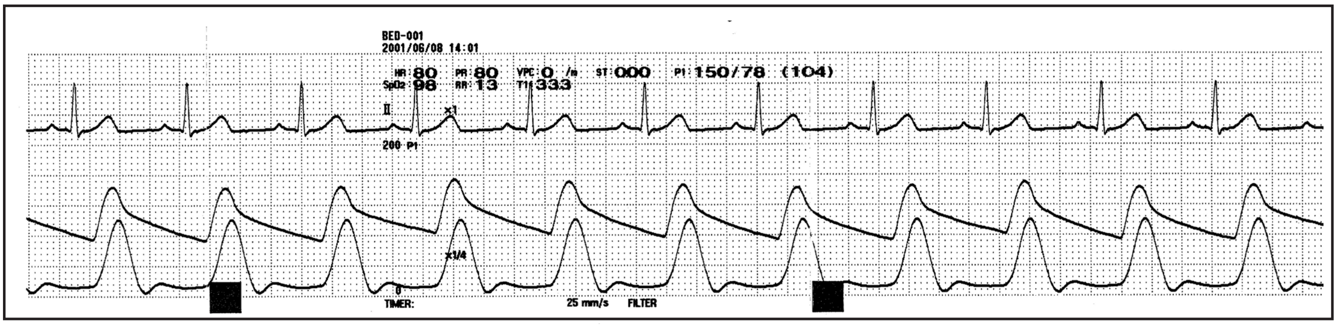
- OCRG:
  The trendgraphs of HR and SpO_2 and compressed respiration waveform are recorded.
- PWTT:
  The PWTT trendgraph on the monitoring screen is recorded.

Periodic recording is only available on the optional recorder.

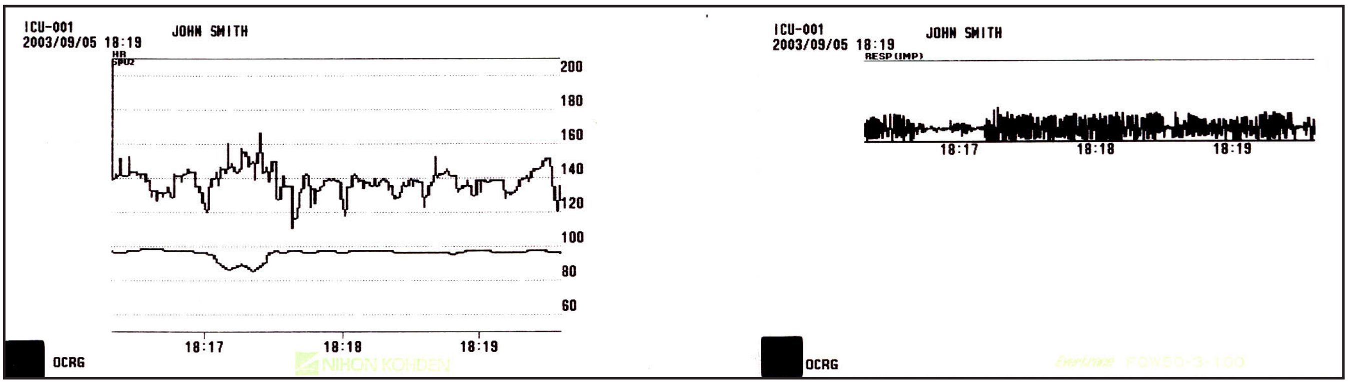
Set the following items on the RECORDING window.

- Periodic recording time interval. When “OFF” is selected, periodic recording is turned off.
- Recording pattern (not necessary when recording the OCRG or PWTT trendgraph)

Recording example



OCRG recording



Alarm Recording

When a vital sign alarm or arrhythmia alarm occurs, ECG and two other waveforms selected on the RECORDING window and vital sign data are automatically recorded. The recorded ECG waveform is from 8 seconds before to 12 seconds after the alarm occurrence.

Set alarm recording on or off on the RECORDING window. For details, refer to Section 6.

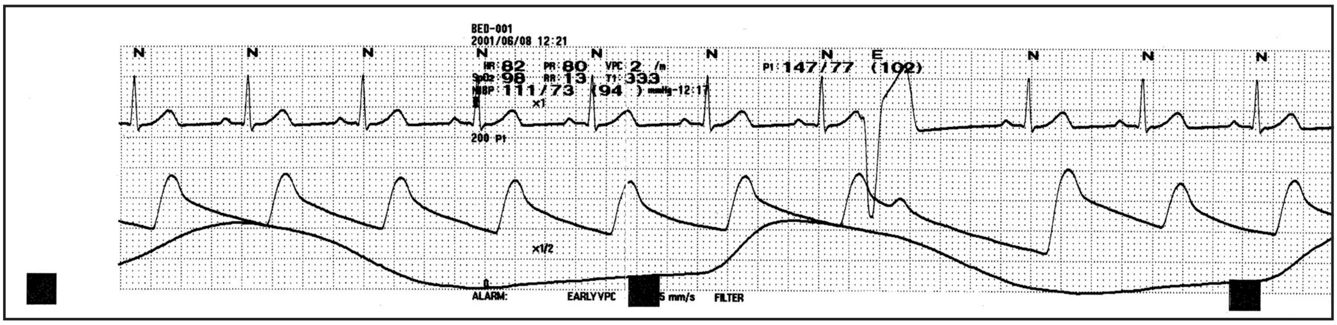
CAUTION

Alarm recording is not performed when:

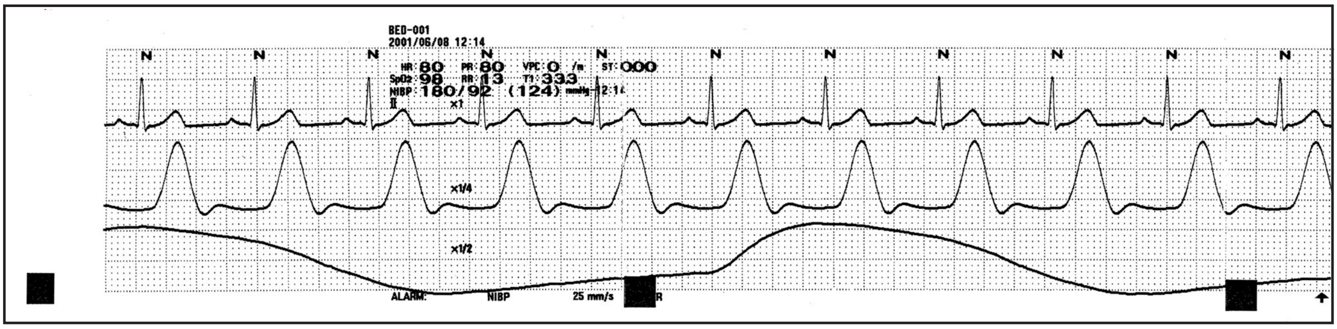
- **Alarm is suspended.**
- **Alarm recording is set to Off.**

Recording example

Arrhythmia alarm recording



Upper/lower limit alarm recording



Recording Mode Annotations

One of the following annotations is printed on each page of the recording paper as shown below.

TIMER:	Automatic periodic recording. Refer to the “Setting Periodic Recording” section.
ALARM:	Automatic recording at an alarm occurrence. Refer to “Turning Automatic Alarm Recording On/Off” in Section 6.
LIST:	List recording. Refer to “List Window” in Section 7.
TREND:	Trendgraph recording. Refer to “Trend Window” in Section 7.
ALARM HISTORY:	Alarm history recording. Refer to “Alarm History Window” in Section 7.
RECALL:	Arrhythmia waveform recording. Refer to “Arrhythmia Recall Window” in Section 7.
MANUAL:	Manual recording.
OCRG:	OCRG recording.
PWTT:	PWTT trendgraph recording.

Recording Priority

If more than one recording mode is activated at the same time, only the highest priority mode is used.

Manually stopping recording by the ⎙ record key   Manual recording   Alarm recording   Periodic recording

High ← Recording priority → Low

If a higher level alarm occurs during another alarm recording, the present alarm recording is cancelled and the higher level alarm is recorded for 20 seconds.

During any type of recording, if a lower or equal priority alarm recording or any other type of recording occurs, that recording is not performed; only the current recording is performed.

Recording Sensitivity

The sensitivity of the waveforms recorded on the recording paper is the same as the sensitivity of the waveforms displayed on the screen.

To change the sensitivity, change the sensitivity setting on the parameter setting window as described in Sections 10 to 16.

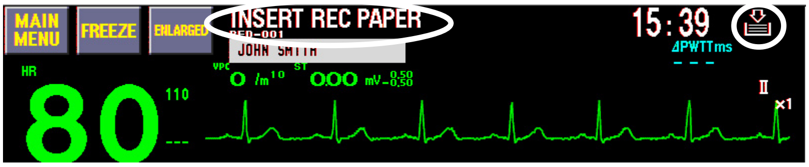
Recording Speed

The recording speed can be set at RECORDING SWEEP SPEED on the RECORDING window.

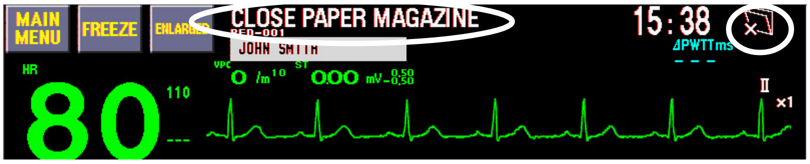
Recording Related Message

The following message and icon appear in the following conditions.

When out of recording paper


INSERT REC PAPER
MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
15:39
ΔPWTTms
HR
80
110
VPC
0 /m
ST
0.00 mV
II
×1

When the recorder door is open


CLOSE PAPER MAGAZINE
MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
15:38
ΔPWTTms
HR
80
110
VPC
0 /m
ST
0.00 mV
II
×1

Recorded/Printed Data

The following data can be recorded.

Printed Items	Example
Patient name	John Smith
Bed ID	BED-001
Date and time of recording	2001/05/11 10:30
Reason for recording	TIMER, ALARM etc.
Sensitivity	×2
Paper speed	25 mm/s
ECG related message	FILTER*[1]
Heart rate (beats/min)	HR: 100
ECG lead	II
Number of VPCs	VPC: 10/min
ST level	−0.04 mV
Pulse rate (beats/min)	PR: 80
SpO_2 (%)	SpO_2: 98
NIBP: SYS/DIA (MEAN) (mmHg), measurement time	NIBP: 132/61 (80) mmHg 17:24
Respiration rate (resp/min)	RR: 14
CO_2 (mmHg)	CO_2: 40
IBP: SYS/DIA (MEAN) (mmHg)	P1: 132/61 (80) mmHg
Temperature (°C/°F)	T1 : 36.4°C
Arrhythmia name	COUPLET
Waveform annotation*[2]	N, V, P etc.

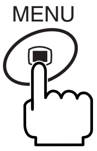
*[1] "FILTER" is printed when FILTERS is set to ON. Refer to Section 10. When the "CHECK ELECTRODES" alarm occurs, "CHECK ELECTRODES" is printed instead of "FILTER".

*[2] Printed when recording mode is MANUAL, ALARM or RECALL and "ARRHYTHMIA ANALYSIS" on the ECG window is set to ON.

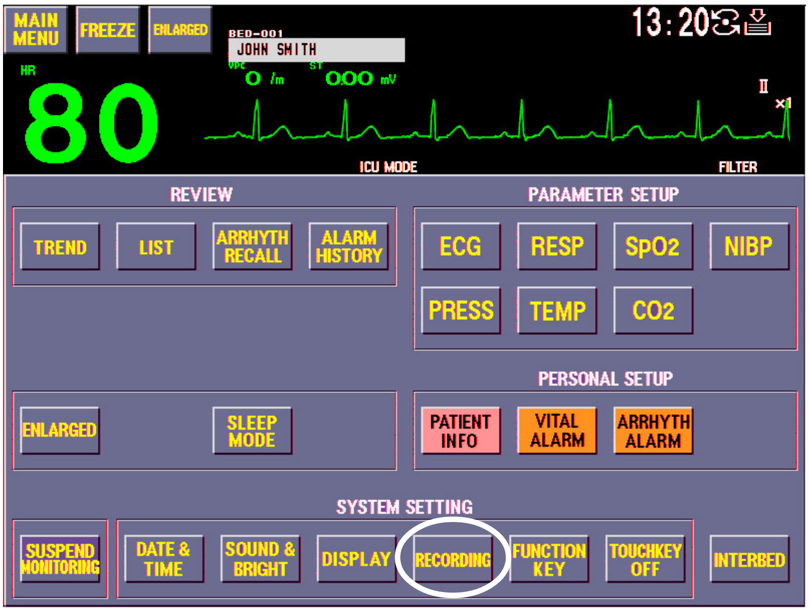
Changing the Recording Pattern

ECG and up to 2 parameter waveforms can be selected for a recording pattern.

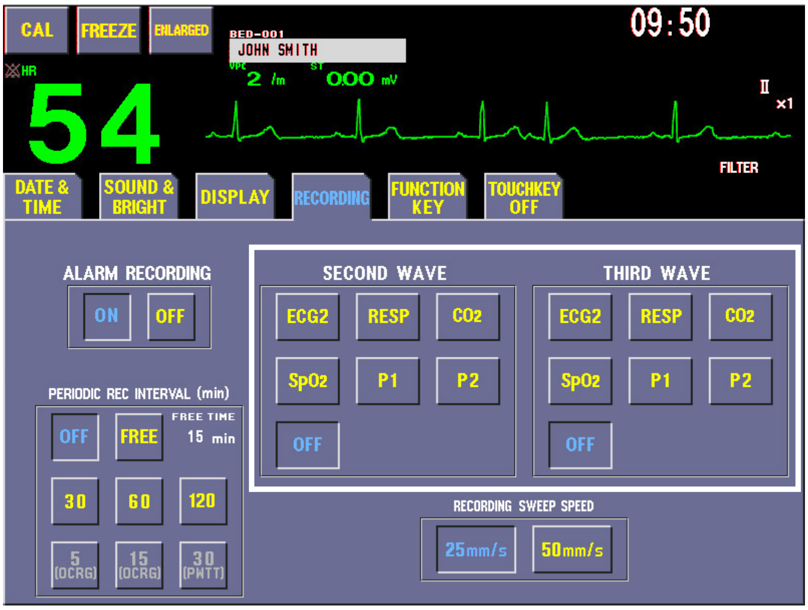
The selected recording pattern applies to all recording except recording on the review windows, OCRG recording and PWTT trendgraph recording. “OFF” (ECG only) is the default setting.



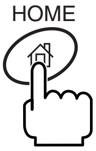
1. Press the MENU key on the front panel to display the MENU window.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC 0 /m
ST 0.00 mV
II
×1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

2. Touch the “RECORDING” key to display the RECORDING window.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
09:50
HR
54
VPC 2 /m
ST 0.00 mV
II
×1
FILTER
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
ALARM RECORDING
ON
OFF
PERIODIC REC INTERVAL (min)
OFF
FREE
FREE TIME 15 min
30
60
120
5 (OCRG)
15 (OCRG)
30 (PWTT)
SECOND WAVE
ECG2
RESP
CO2
SpO2
P1
P2
OFF
THIRD WAVE
ECG2
RESP
CO2
SpO2
P1
P2
OFF
RECORDING SWEEP SPEED
25mm/s
50mm/s

3. Select the parameter by touching the parameter key in the SECOND WAVE box and THIRD WAVE box. Select “OFF” when recording only ECG. P2 is not available on BSM-2301/2351.

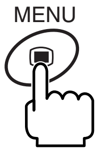


4. Press the HOME key on the front panel to return to the monitoring screen.

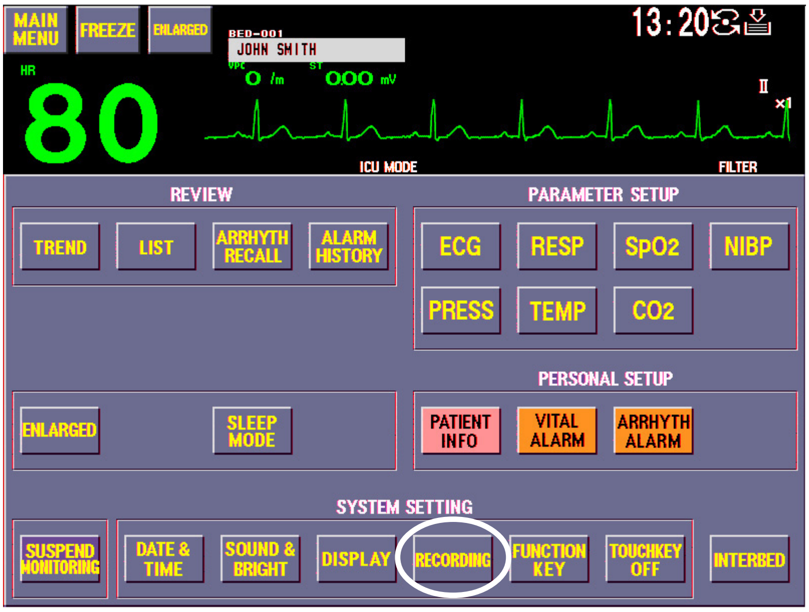
Changing the Recording Speed

The recording speed for the recording on the optional recorder can be selected from 25 or 50 mm/s.

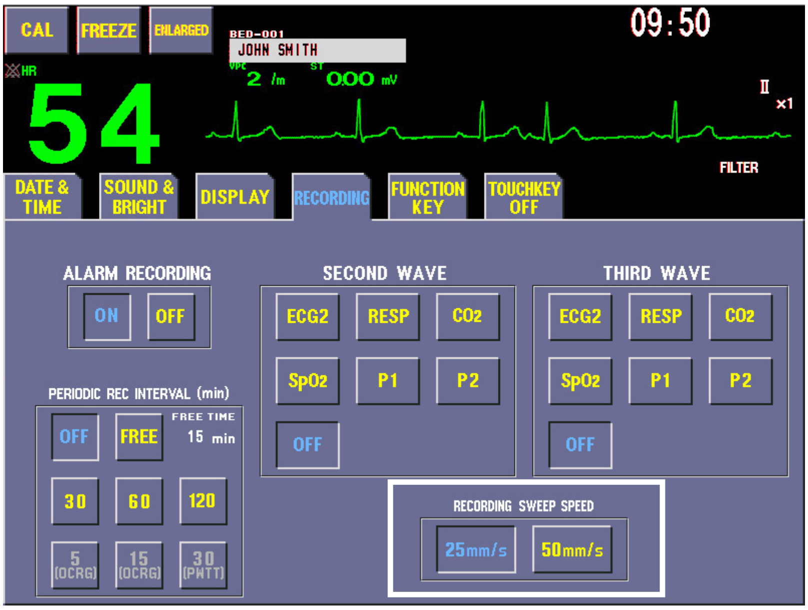
Recording speed and waveform sweep speed on the screen can be set separately.

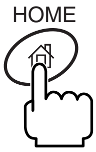


1. Press the MENU key on the front panel to display the MENU window.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
VPC
0 /m
ST
0.00 mV
13:20
HR
80
II
×1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

2. Touch the “RECORDING” key to display the RECORDING window.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
VPC
2 /m
ST
0.00 mV
09:50
HR
54
II
×1
FILTER
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
ALARM RECORDING
ON
OFF
SECOND WAVE
ECG2
RESP
CO2
SpO2
P1
P2
OFF
THIRD WAVE
ECG2
RESP
CO2
SpO2
P1
P2
OFF
PERIODIC REC INTERVAL (min)
OFF
FREE
FREE TIME
15 min
30
60
120
5 (OCRG)
15 (OCRG)
30 (PWTT)
RECORDING SWEEP SPEED
25mm/s
50mm/s



3. Touch the desired speed in the RECORDING SWEEP SPEED box.

4. Press the HOME key on the front panel to return to the monitoring screen.

Manually Recording/Printing Waveforms

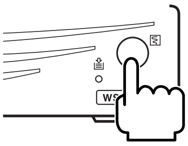
Recording Waveforms on the Optional Recorder

Waveforms and data can be recorded manually on the optional WS-231P recorder module.

There are four settings:

- Recording pattern: This setting determines which of the measured parameter waveforms are recorded. See the “Changing the Recording Pattern” section.
- Realtime or Delay mode: In DELAY mode, recording begins with the waveforms acquired 8 seconds before recording starts. In REAL TIME mode, recording begins with the waveforms being acquired when recording starts. To select realtime or delayed manual recording mode, refer to Section 3.
- Recording length: CONTINUOUS, 10, 20 or 30 seconds can be selected for the recording length on the SYSTEM SETUP screen. Refer to Section 3.
- Recording speed: The recording speed can be set at RECORDING SWEEP SPEED on the RECORDING window.

1. If necessary, select the recording pattern on the RECORDING window. Refer to the “Changing the Recording Pattern” section.



2. To start recording, press the ▤ record key on the recorder module.
3. To stop recording, press the ▤ record key again.

Recording OCRG on the Optional Recorder

OCRG on the monitoring screen can be recorded manually on the optional WS-231P recorder module by touching the “OCRG RECORD” key at the upper left corner of the screen (function key).

To record, the OCRG RECORD must be assigned to one of the function keys in the upper left corner of the screen. Refer to “Assigning a Function to the Function Keys” in Section 4.

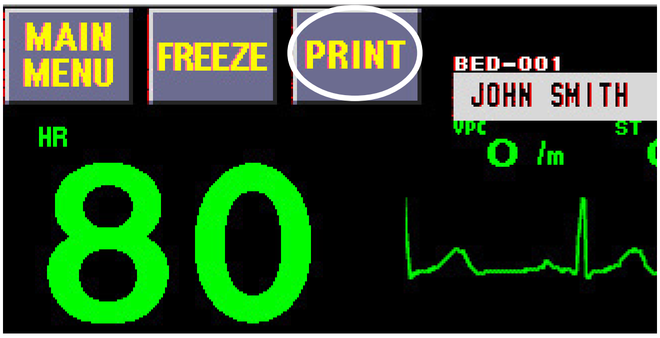
Recording PWTT Trendgraph on the Optional Recorder

PWTT trendgraph on the monitoring screen can be recorded manually on the optional WS-231P recorder module by touching the “PWTT RECORD” key at the upper left corner of the screen (function key).

To record, the PWTT RECORD must be assigned to one of the function keys in the upper left corner of the screen. Refer to “Assigning a Function to the Function Keys” in Section 4.

Manual Printing on the Network Printer

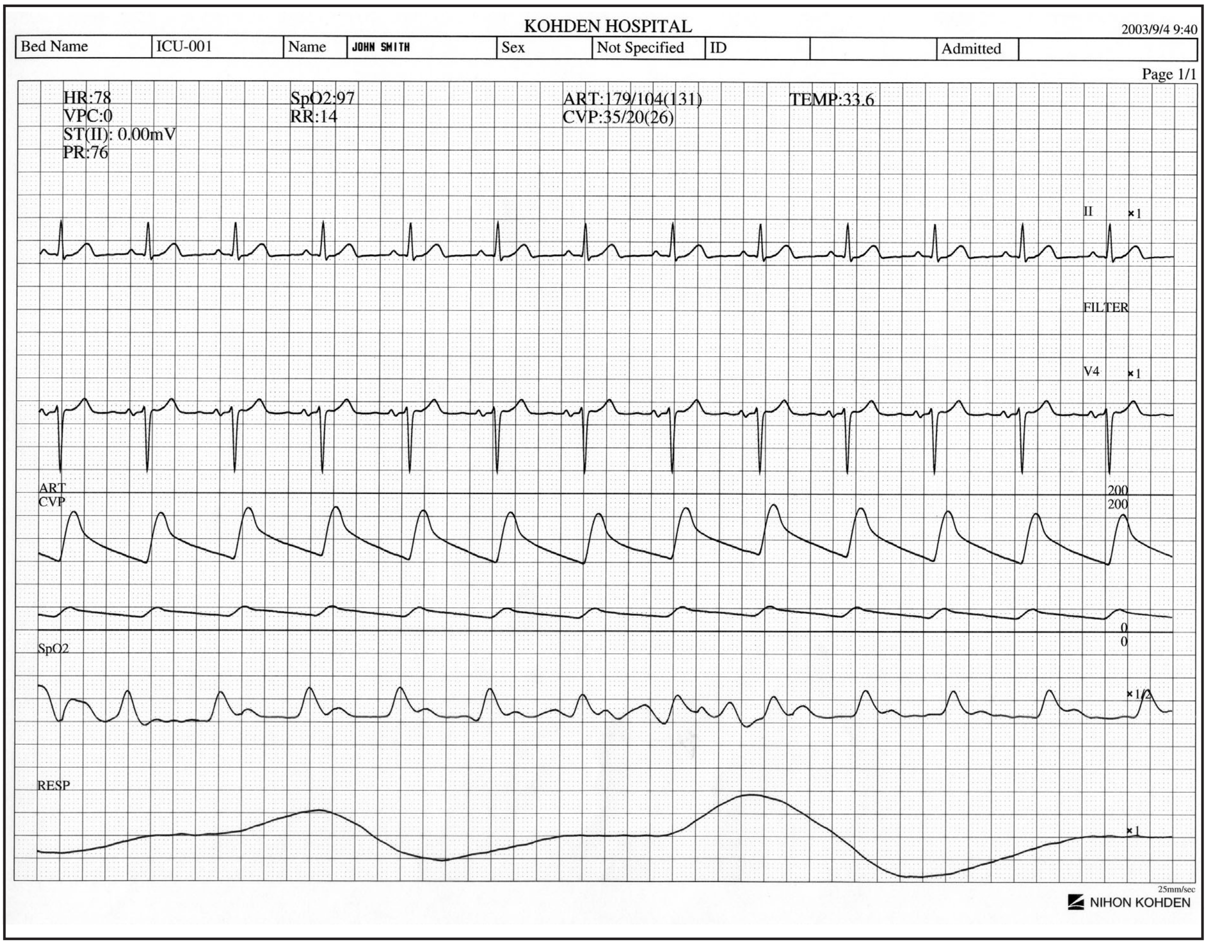
When the bedside monitor is connected to a network printer with the QI-111P network printer card, all monitoring waveforms and numeric data can be printed on the network printer. The waveforms from 7 seconds before to 3 seconds after the “PRINT” key at the upper left corner of the screen (function key) is pressed are printed.



To print, the print function must be assigned to one of the function keys in the upper left corner of the screen. Refer to “Assigning a Function to the Function Keys” in Section 4.

For details about printing on the network printer, refer to the “Printing on a Network Printer” section.

Printing Example



KOHDEN HOSPITAL

2003/9/4 9:40

Bed Name	ICU-001	Name	JOHN SMITH	Sex	Not Specified	ID		Admitted	

Page 1/1

HR:78
VPC:0
ST(II): 0.00mV
PR:76

SpO2:97
RR:14

ART:179/104(131)
CVP:35/20(26)

TEMP:33.6

Setting Periodic Recording

You can select one of the three types of recording data:

- ECG and up to two waveforms with numerical data
- OCRG
- PWTT trendgraph

From the bedside monitor, automatic periodic recording cannot be performed on the central monitor recorder.

ECG and up to two waveforms with numerical data

A 10 second waveform can be automatically recorded at preset intervals of 30, 60, 120 minutes or “free” interval. If you select FREE, you can set the desired interval.

Recording starts at the nearest half-hour for 30 min interval, at the nearest hour for 60 or 120 min interval and at the next FREE interval for FREE recording.

For example, if you start automatic periodic recording at 9:20 with 30 min interval, periodic recording will be performed at 9:30, 10:00, 10:30 and so on. If you start it at 9:20 with 120 min interval, periodic recording will be performed at 10:00, 12:00, 14:00 and so on. If you start it at 9:20 with FREE 65 min interval, periodic recording will be performed at 10:25, 11:30, 12:35 and so on.

OCRG

The trendgraphs of HR and SpO_2 and compressed respiration waveform are recorded. The OCRG is recorded every 5 minutes when 5(OCRG) is selected in the PERIODIC REC INTERVAL box on the RECORDING window, and every 15 minutes when 15(OCRG) is selected.

The OCRG recording has two pages. The first page contains HR and SpO_2 trendgraphs and the second page contains compressed respiration waveform.

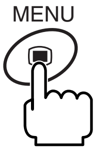
PWTT trendgraph

PWTT tredgraph on the monitoring screen are recorded every 30 minutes when 30(PWTT) is selected in the PERIODIC REC INTERVAL box on the RECORDING window.

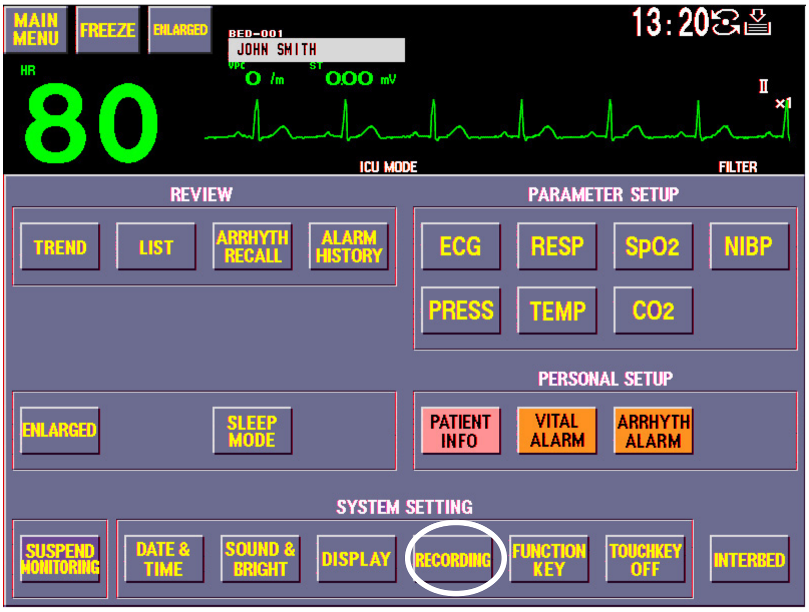
Changing Settings for Automatic Periodic Recording

There are two settings:

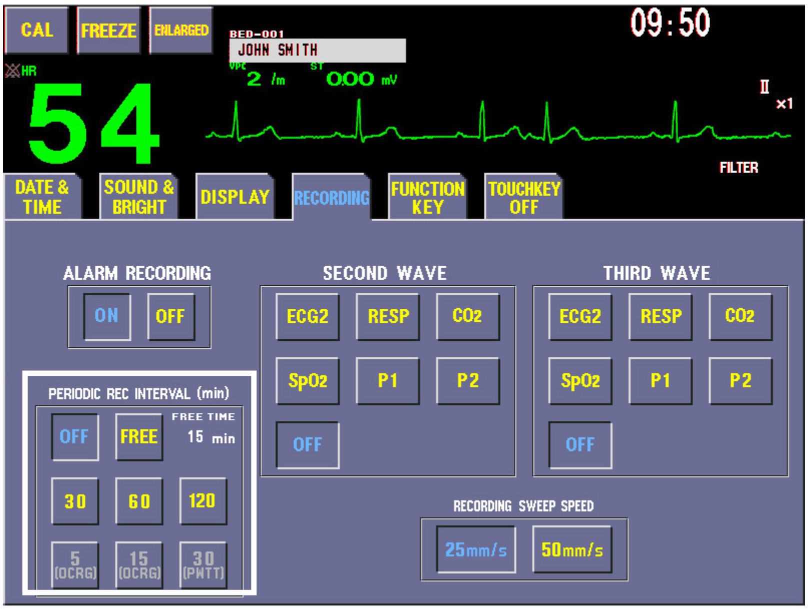
- Periodic recording on/off: Recording interval must be selected on the RECORDING window to automatically record waveform and data at periodic interval. See below.
- FREE time interval: You can set the desired interval for automatic periodic recording on PERIODIC FREE INTERVAL on the SYSTEM SETUP screen. FREE selection is from 1 to 120 minutes (1 min/step). Default setting is 15 min. See Section 3, RECORD SETUP.



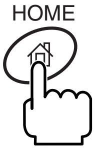
1. Press the MENU key on the front panel to display the MENU window.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC
0 /m
ST
0.00 mV
II
×1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

2. Touch the “RECORDING” key to display the RECORDING window.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
09:50
HR
54
VPC
2 /m
ST
0.00 mV
II
×1
FILTER
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
ALARM RECORDING
ON
OFF
SECOND WAVE
ECG2
RESP
CO2
SpO2
P1
P2
OFF
THIRD WAVE
ECG2
RESP
CO2
SpO2
P1
P2
OFF
PERIODIC REC INTERVAL (min)
OFF
FREE
FREE TIME
15 min
30
60
120
5 (OCRG)
15 (OCRG)
30 (PWTT)
RECORDING SWEEP SPEED
25mm/s
50mm/s

3. Select the recording interval in the PERIODIC REC INTERVAL box. Select “OFF” when not performing periodic recording.



4. Press the HOME key on the front panel to return to the monitoring screen.

Printing on a Network Printer

When the bedside monitor is connected to a network printer with the optional QI-111P network printer card, the following printing is available.

- Real-time waveform printing:
  Prints the waveforms from 7 seconds before to 3 seconds after the "PRINT" key at the upper left corner of the screen (function key) is touched.

- Printing data on the review windows:
  Prints the displayed trendgraphs when the "PRINT START" key on the TREND window is touched.

  The displayed list or stored list can be printed when the "PRINT PAGE" or "PRINT ALL" key on the LIST window is touched.

  The displayed arrhythmia recall waveform is printed when the "PRINT START" key on the ARRHYTH RECALL window is touched.

To print on the network printer, the printer properties (IP address, printer name, paper size and color mode) must be set on the PRINTER SETUP screen of the SYSTEM SETUP screen. Refer to Section 3.

Section 9 Interbed Window

Registering Interbed Beds 9.2

Removing an Interbed Bed 9.3

Displaying the Interbed Bed Data 9.4

Interbed Alarm 9.6

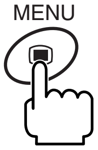
Setting Interbed Alarm On or Off 9.6

When the monitor is in a monitor network, you can display waveforms, parameter data and alarm status of another bed in the network on the INTERBED window. This function lets the nursing staff check an alarm occurrence or condition of a remote patient without actually going to the alarmed or remote bed. With the interbed function, this monitor can receive data from any other selected monitor regardless of the settings on that monitor.

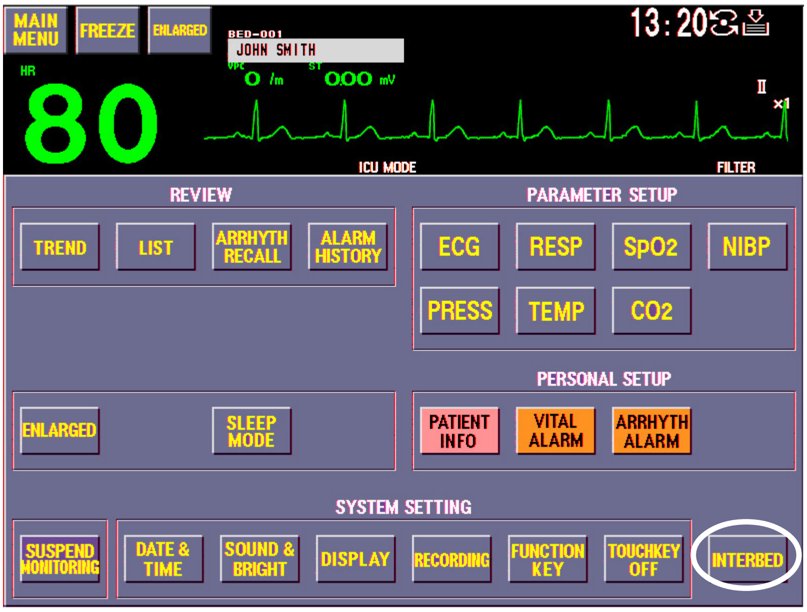
Registering Interbed Beds

To view another bed, you must register the bed as an interbed bed. Only registered beds can be viewed. You can register up to 8 interbed beds. Any bed in the monitor network can be registered as an interbed bed.

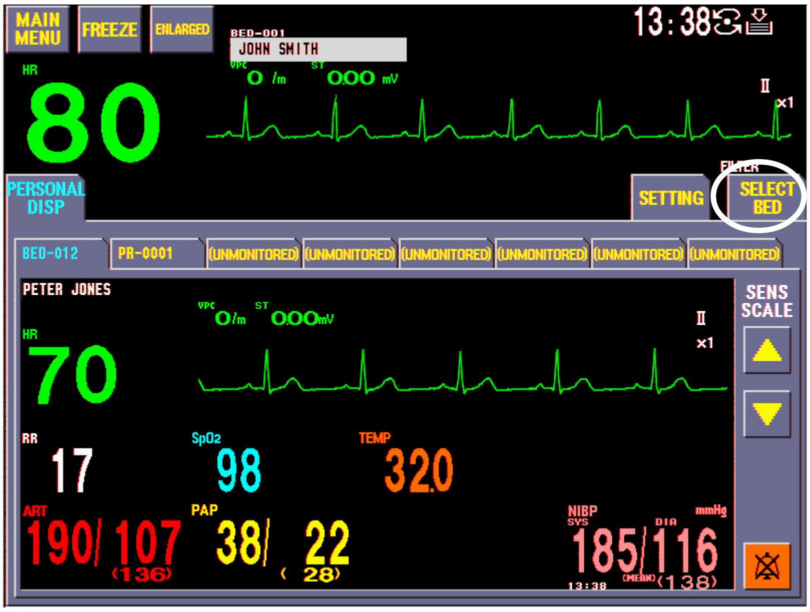
When registering an interbed bed, the power of the bedside monitor to be registered must be turned on.



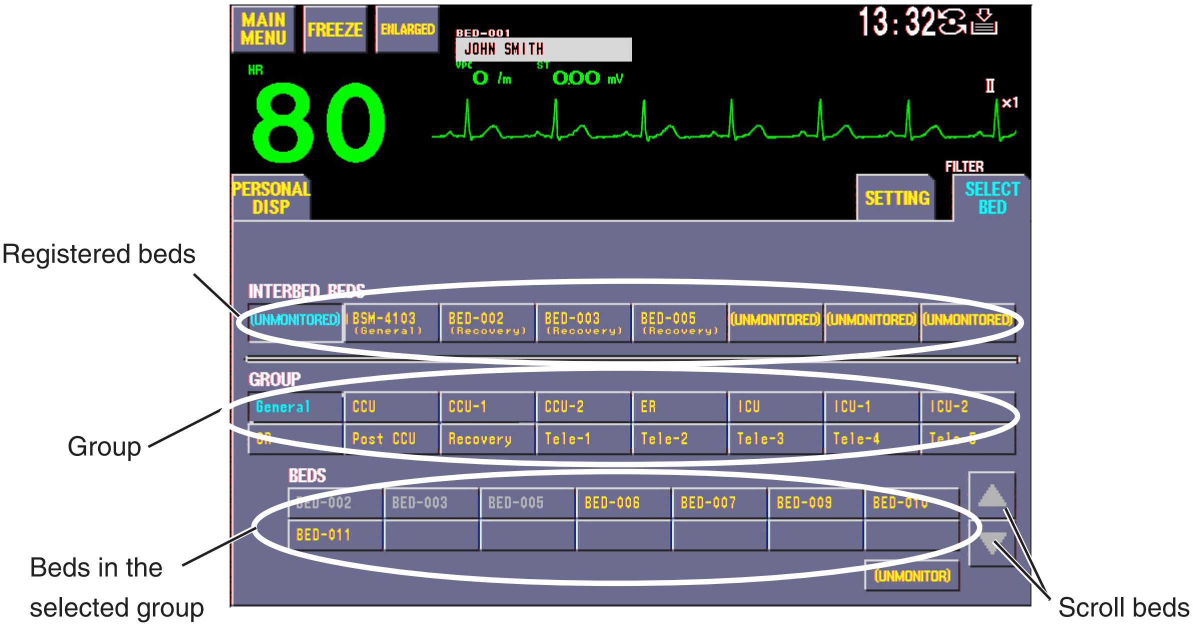
1. Press the MENU key on the front panel. The MENU window appears.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC 0 /m
ST 0.00 mV
II
×1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

2. Touch the "INTERBED" key to display the INTERBED window.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:38
HR
80
VPC 0 /m
ST 0.00 mV
II
×1
FILTER
PERSONAL DISP
SETTING
SELECT BED
BED-012
PR-0001
(UNMONITORED)
(UNMONITORED)
(UNMONITORED)
(UNMONITORED)
(UNMONITORED)
(UNMONITORED)
PETER JONES
VPC 0 /m
ST 0.00 mV
II
×1
SENS SCALE
HR
70
RR
17
SpO2
98
TEMP
32.0
ART
190/107
(136)
PAP
38/22
(28)
NIBP SYS DIA mmHg
185/116
13:38 (MEAN) (138)

3. Touch the “SELECT BED” tab to display the SELECT BED window.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:32
HR
80
VPC
0 /m
ST
0.00 mV
II
×1
FILTER
PERSONAL DISP
SETTING
SELECT BED
INTERBED BEDS
(UNMONITORED)
BSM-4103 (General)
BED-002 (Recovery)
BED-003 (Recovery)
BED-005 (Recovery)
(UNMONITORED)
(UNMONITORED)
(UNMONITORED)
GROUP
General
CCU
CCU-1
CCU-2
ER
ICU
ICU-1
ICU-2
OR
Post CCU
Recovery
Tele-1
Tele-2
Tele-3
Tele-4
Tele-5
BEDS
BED-002
BED-003
BED-005
BED-006
BED-007
BED-009
BED-010
BED-011
(UNMONITOR)
Registered beds
Group
Beds in the selected group
Scroll beds

4. Select the position to which you want to register the interbed bed in the INTERBED BEDS box.

5. Select the group from which you want to select the interbed bed from the GROUP box. The beds in the selected group are listed in the BEDS box.

6. Select the interbed bed from the BEDS box.

Removing an Interbed Bed

1. Select the interbed bed to be removed from the INTERBED BEDS box.

2. Touch the “UNMONITOR” key in the BEDS box.

Displaying the Interbed Bed Data

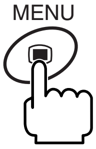
On the INTERBED window, heart rate and ECG waveform of the first trace are always displayed. Other numerical data from the following list can be displayed. The ECG waveform can be replaced with another parameter waveform by touching the parameter numerical data. The parameters are listed in the display priority. Other parameters cannot be displayed.

Numeric Data

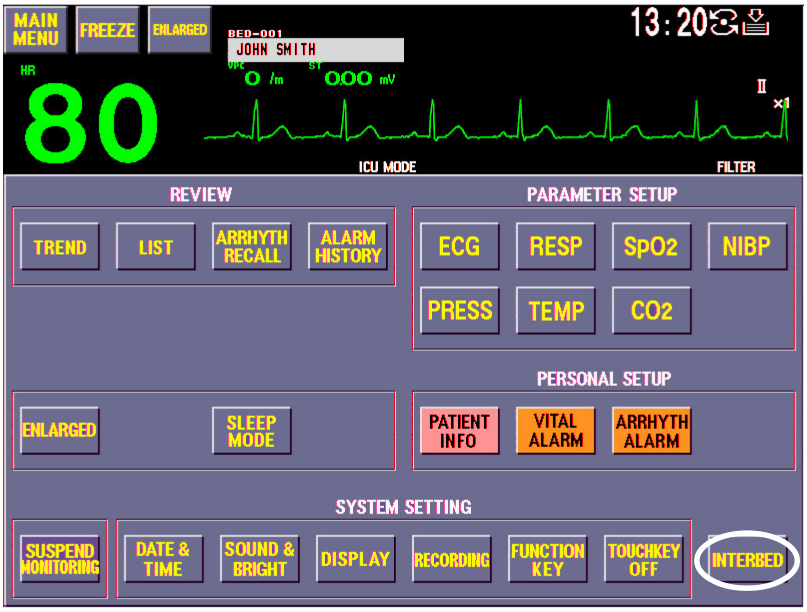
- Pulse rate
- VPC
- ST
- Respiration rate
- CO_2
- SpO_2
- NIBP
- Temperature
- PRESS1
- PRESS2

Waveform

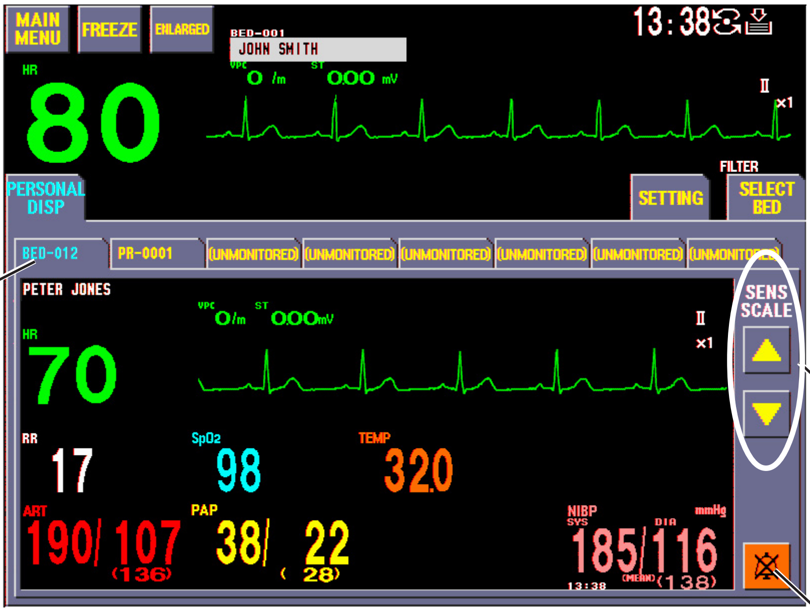
- Respiration/CO_2
- SpO_2
- PRESS1
- PRESS2



1. Press the MENU key on the front panel. The MENU window appears.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC
0 /m
ST
0.00 mV
II
×1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

2. Touch the “INTERBED” key to display the INTERBED window.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:38
HR
80
VPC 0 /m
ST 0.00 mV
II
×1
FILTER
PERSONAL DISP
SETTING
SELECT BED
BED-012
PR-0001
(UNMONITORED)
(UNMONITORED)
(UNMONITORED)
(UNMONITORED)
(UNMONITORED)
(UNMONITORED)
PETER JONES
VPC 0/m
ST 0.00mV
HR
70
II
×1
SENS SCALE
RR
17
SpO2
98
TEMP
32.0
ART
190/ 107
(136)
PAP
38/ 22
(28)
NIBP SYS
DIA
mmHg
185/116
13:38
(MEAN)(138)

Select interbed bed to display monitoring data

Changes sensitivity or scale of the waveform

Silences the interbed alarm

3. Touch the “PERSONAL DISP” tab to display the data of an interbed bed.

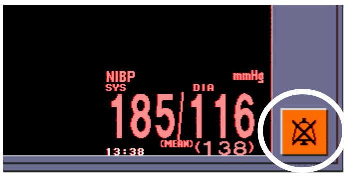
To change beds, select the tab of a different bed.

To change the waveform, touch the numerical data of the parameter you want to display for the waveform.

Interbed Alarm

When an alarm occurs on an interbed bed, an “ALARM bed name” message appears on the monitoring screen. This interbed alarm message does not indicate the type of alarm. Display the INTERBED window to check the alarming bed and the type of alarm. The bed ID of the alarmed bed is highlighted.

The interbed alarm can be set to on or off. When set to ON, the highlighted “ALARM bed name” message is displayed and three “bings” sound on an interbed alarm occurrence. When set to OFF, only the non-highlighted message is displayed.

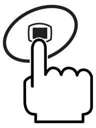

NIBP
SYS
DIA
mmHg
185/116
13:38
(MEAN)(138)

You can also silence the interbed alarm by touching the 🔕 key on the PERSONAL DISP window of the INTERBED window. Silencing the interbed alarm on this monitor also silences the alarm on the alarmed bed itself. The alarm silence indication on the alarmed bed depends on the alarmed bed specifications. The alarm silence time depends on the setting on the alarmed bed.

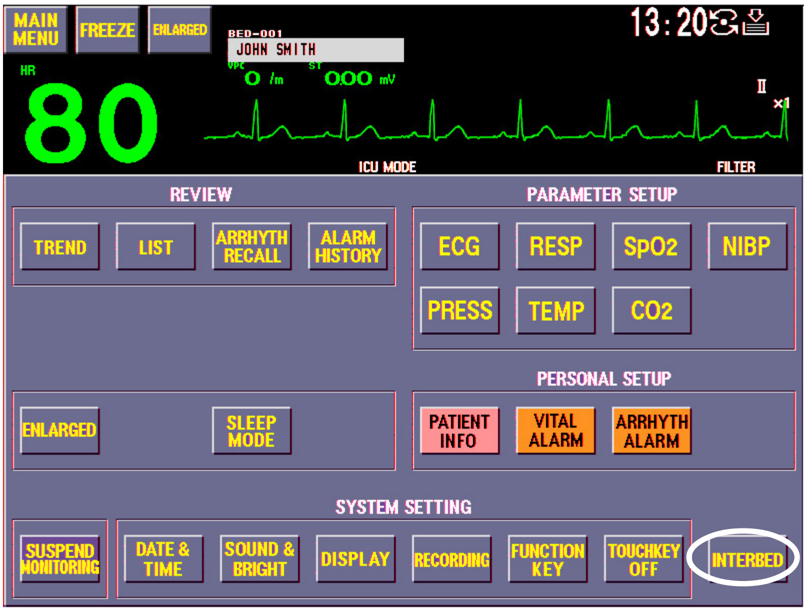
The interbed alarm can only be suspended on the alarmed bed.

Setting Interbed Alarm On or Off

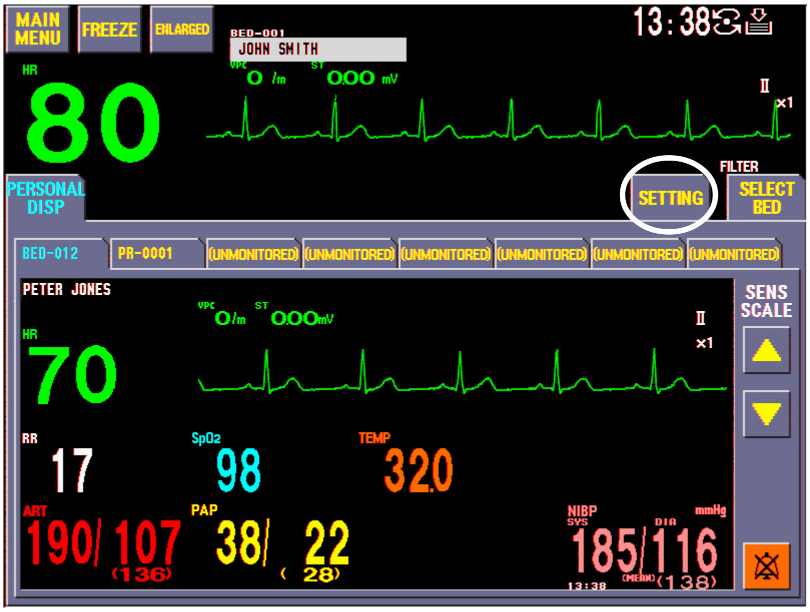
MENU



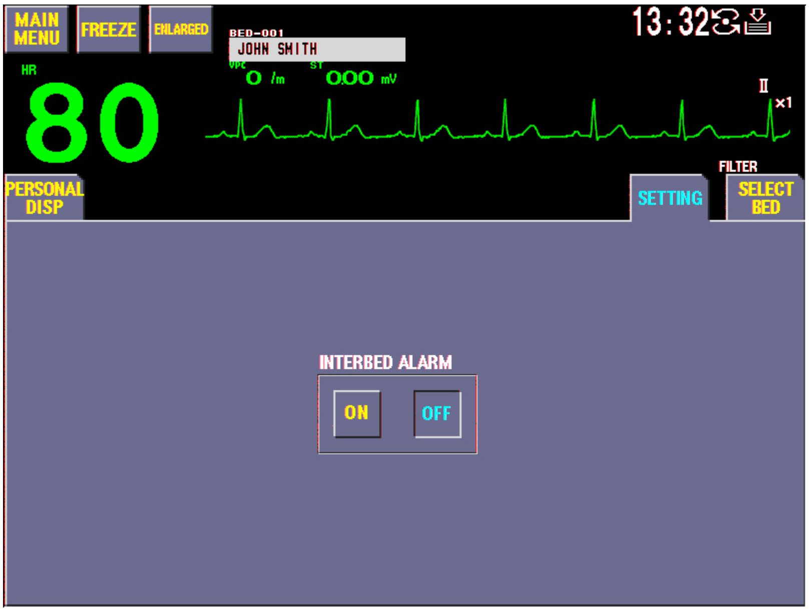
1. Press the MENU key on the front panel. The MENU window opens.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC
0 /m
ST
0.00 mV
II
×1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

2. Touch the “INTERBED” key to display the INTERBED window.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:38
HR
80
PERSONAL DISP
SETTING
FILTER
SELECT BED
BED-012
PR-0001
(UNMONITORED)
PETER JONES
HR 70
SENS SCALE
RR 17
SpO2 98
TEMP 32.0
ART 190/107 (136)
PAP 38/22 (28)
NIBP 185/116 (138)

3. Touch the “SETTING” tab to display the SETTING window.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:32
HR
80
PERSONAL DISP
SETTING
FILTER
SELECT BED
INTERBED ALARM
ON
OFF

4. Select “ON” or “OFF”.

Section 10 ECG Monitoring

General 10.1
Preparing for ECG Monitoring 10.2
    Preparation Flowchart 10.2
    Selecting a Lead 10.2
    Number of Electrodes and Measuring Leads 10.3
    Electrode Position 10.3
        3 Electrode Leads 10.3
        6 Electrode Leads 10.4
    Selecting Electrodes and Lead 10.5
        Types of Leads and Connection Cord 10.5
    Connecting Cables and Attaching Disposable Electrodes 10.6
        Connecting the Electrode Cable to the Monitor 10.6
        Attaching Disposable Electrodes to the Patient 10.7
Monitoring ECG 10.8
    ECG Information on the Monitoring Screen 10.8
    Measuring ST Level 10.9
    Monitoring Arrhythmia 10.10
        Arrhythmia Analysis Classification Messages 10.10
        Turning Arrhythmia Analysis On/Off 10.11
        Learning the ECG Waveform for Arrhythmia Detection (VPC Learning) 10.12
        Changing the Dominant QRS 10.14
    Noise Detection and Display 10.15
    Detached Electrode Detection and Display 10.16
Changing ECG Settings 10.17
    Changing the Monitoring Lead 10.17
    Changing the ECG Sensitivity 10.20
    Changing the Heart Rate or Pulse Rate and ST Alarm Limits 10.21
    Changing the Arrhythmia Alarm Setting 10.22
    Changing the Type of Electrode Cable and Leads 10.24
    Changing the Sync Source 10.26
    Turning the Filters On/Off 10.27
    Selecting the Mode for Updating the Heart Rate 10.29
    Turning Pacing Spike Detection On/Off 10.30
    Displaying the Pacing Mark on the ECG 10.32
Use with an Electrosurgical Unit 10.33

General

ECG is monitored by attaching disposable electrodes to the patient and using the ECG/RESP socket on the monitor. Arrhythmia can be analyzed and ST level is also measured. When using 3 electrodes, one lead can be monitored. When using 6 electrodes, two leads can be monitored.

WARNING

Interaction Between Minute Ventilation Rate-Adaptive Pacemakers and Cardiac Monitoring and Diagnostic Equipment*

The bioelectric impedance measurement sensor of a minute ventilation rate-adaptive implantable pacemaker may be affected by cardiac monitoring and diagnostic equipment which is connected to the same patient. If this occurs, the pacemaker may pace at its maximum rate and give incorrect data to the monitor or diagnostic equipment. If this occurs, disconnect the monitor or diagnostic equipment from the patient or change the setting on the pacemaker by referring to the pacemaker's manual. For more details, contact your pacemaker distributor or Nihon Kohden distributor.

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* Minute ventilation is sensed in rate-adaptive pacemakers by a technology known as bioelectric impedance measurement (BIM). Many medical devices in addition to pacemakers use this technology. When one of these devices is used on a patient with an active, minute ventilation rate-adaptive pacemaker, the pacemaker may erroneously interpret the mixture of BIM signals created in the patient, resulting in an elevated pacing rate.

For more information, see the FDA web site.
http://www.fda.gov/cdrh/safety.html

Preparing for ECG Monitoring

Preparation Flowchart

1. Select the electrode lead.

2. Connect the electrode lead to the ECG connection cord and ECG connection cord to the ECG/RESP socket on the monitor.

3. Attach the disposable electrodes to the patient and attach the electrode lead to the electrodes.

4. Monitoring starts. Set necessary settings.
   For handling accessories after use, refer to Section 18.

Selecting a Lead

NOTE

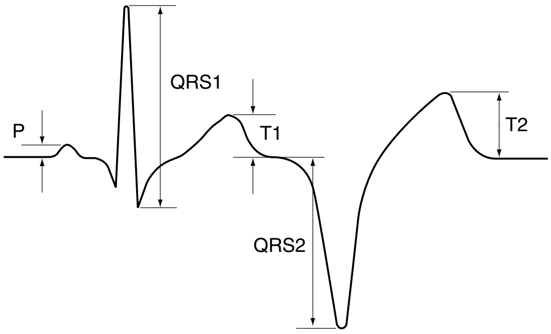
Follow the physician's instructions for lead position when available.

It is generally considered that Lead II and Lead V1 are suitable for arrhythmia monitoring and that Lead V4 and Lead V5 are suitable for myocardial ischemia monitoring.

Some types of ECGs are difficult for automatic analysis, and heart rate or arrhythmia detection level is not accurate for some patients. In these cases, use the following procedure to find the appropriate lead for automatic analysis.

1. Measure the patient's ECG with the standard 12 ECG leads using an ECG instrument.

2. Select the optimum lead according to the following guidelines:
   1) Select the lead with the highest QRS wave amplitude and least difference in amplitude compared with a VPC or pacing pulse.
      $0.5 \leq QRS1/QRS2 \leq 2$
   2) Select the lead with less than 0.2 mV amplitude of the P-wave.
      $P \leq 0.2$ mV
   3) Select the lead with a T-wave amplitude which is less than one-third of the QRS wave.
      $T1 \leq 1/3QRS1$, $T2 \leq 1/3QRS2$



Number of Electrodes and Measuring Leads

The leads which can be monitored differ according to the type of electrode lead and number of electrodes used. This monitor automatically identifies the number of electrodes attached to the patient.

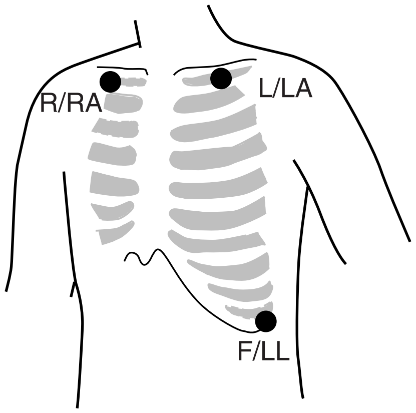
No. of Electrodes	Lead	Features
3	I, II, III	Can measure at the thoracic wall.
6	I, II, III, aVR, aVL, aVF, Va, Vb	Similar to the standard 12 lead.

Electrode Position

3 Electrode Leads

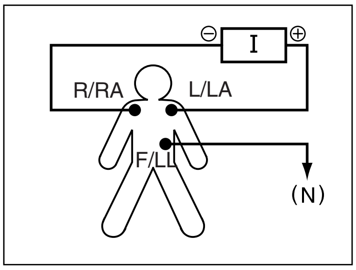
Electrode Position

Symbol	Lead Color (Clip Color)	Electrode Position
R RA	Red (Red-beige) White (White-beige)	Right infraclavicular fossa
L LA	Yellow (Yellow-beige) Black (Black-beige)	Left infraclavicular fossa
F LL	Green (Green-beige) Red (Red-beige)	Lowest rib on the left anterior axillary line

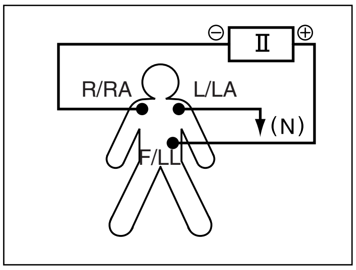


Lead Connection

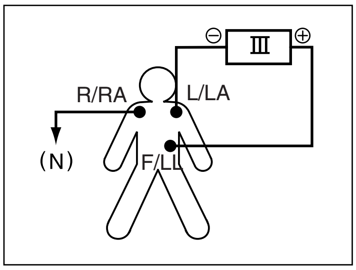
Lead I

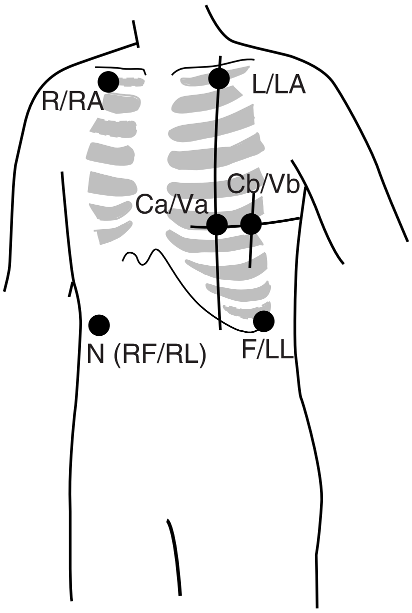


Lead II



Lead III




R/RA
L/LA
Cb/Vb
Ca/Va
N (RF/RL)
F/LL

6 Electrode Leads

Electrode Position

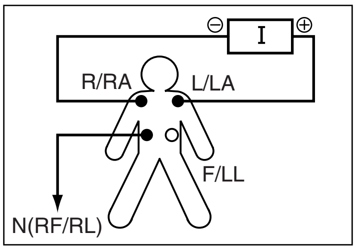
The 6-electrode method with lead II and lead V5 is effective for monitoring myocardial ischemia. You can improve monitoring accuracy considerably by adding lead V4 to this combination. Ca and Cb (Va and Vb) can be at any position of the standard 12 leads C1 to C6 (V1 to V6), but C4 and C5 (V4 and V5) are most appropriate for myocardial ischemic monitoring.

Symbol	Lead Color (Clip Color)	Electrode Position
R RA	Red (Red-beige) White (White-beige)	Right infraclavicular fossa
L LA	Yellow (Yellow-beige) Black (Black-beige)	Left infraclavicular fossa
F LL	Green (Green-beige) Red (Red-beige)	Lowest rib on the left anterior axillary line
N (RF) N (RL)	Black (Black-beige) Green (Green-beige)	Right anterior axillary line at the same level as F.
Ca Va	White (Brown-white) Brown (Blue-brown)	Fifth intercostal space on the left midclavicular line. (C4 position of standard 12 leads)
Cb Vb	White (Black-white) Brown (Orange-brown)	Left anterior axillary line at the same level as Ca. (C5 position of standard 12 leads)

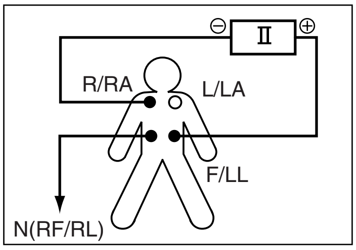
Lead Position

Standard limb leads

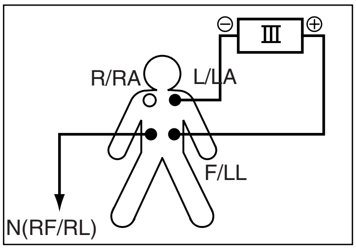
Lead I


⊖ I ⊕
R/RA
L/LA
F/LL
N(RF/RL)

Lead II

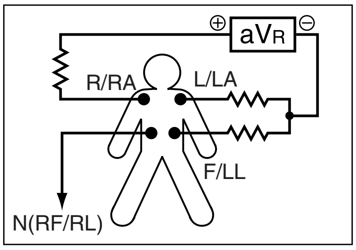

⊖ II ⊕
R/RA
L/LA
F/LL
N(RF/RL)

Lead III

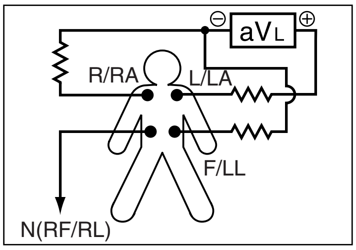

⊖ III ⊕
R/RA
L/LA
F/LL
N(RF/RL)

Monopolar limb leads

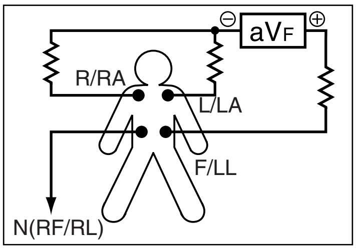
aVR lead


⊕ aVR ⊖
R/RA
L/LA
F/LL
N(RF/RL)

aVL lead

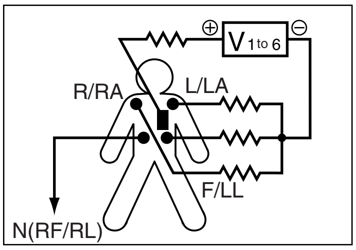

⊖ aVL ⊕
R/RA
L/LA
F/LL
N(RF/RL)

aVF lead


⊖ aVF ⊕
R/RA
L/LA
F/LL
N(RF/RL)

Monopolar chest leads

V1 to V6 leads


⊕ V1 to 6 ⊖
R/RA
L/LA
F/LL
N(RF/RL)

Selecting Electrodes and Lead

Select the appropriate electrodes and lead according to the purpose.

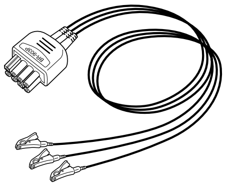
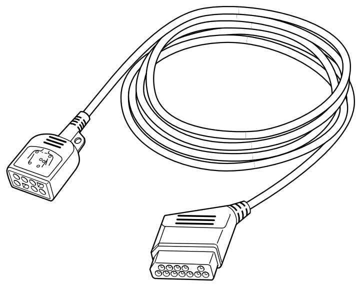
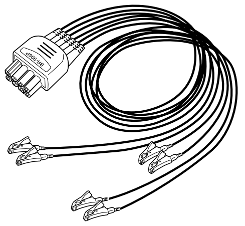
WARNING

When using a defibrillator together with the monitor, use Ag/AgCl electrodes. Other types of electrodes, stainless steel in particular, will adversely affect the ECG waveform by slowing the baseline recovery on the monitor and result in no monitoring immediately following defibrillation.

CAUTION

- **Use only Nihon Kohden products and specified parts and accessories. When other type of electrodes are used, the "CHECK ELECTRODES" message may be displayed and monitoring may stop.**
- **Do not reuse disposable electrodes.**

Types of Leads and Connection Cord

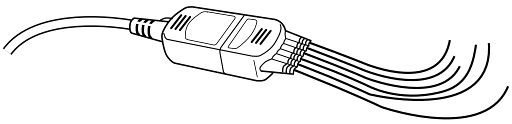
No. of Electrodes	Electrode Lead	ECG Connection Cord
3 (I, II, III)	BR-903PA (AHA, clip type) BR-913PA* (AHA, snap type) 	JC-906PA (AHA) 
6 (I, II, III, aVR, aVL, aVF, Va, Vb)	BR-906PA (AHA, clip type) BR-916PA* (AHA, snap type) 	

* These parts have not been checked for compliance with the MDD (Medical Device Directive). For EC member countries, Nihon Kohden recommends the use of parts that comply with MDD.

Connecting Cables and Attaching Disposable Electrodes

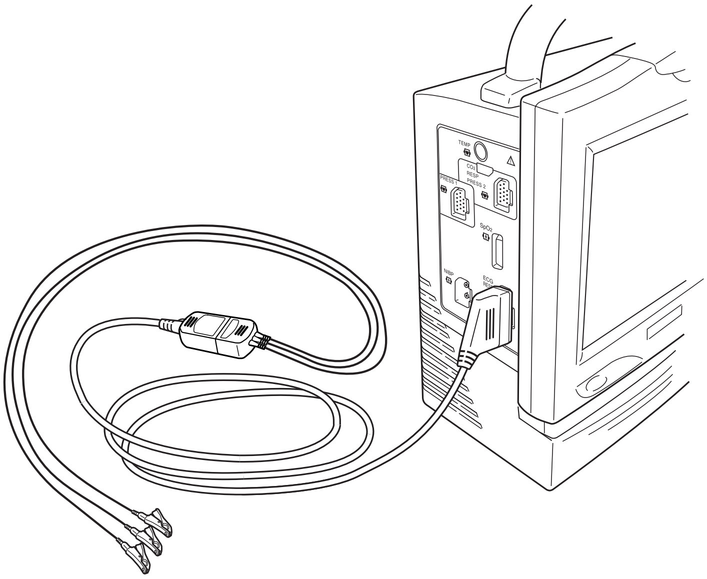
Connecting the Electrode Cable to the Monitor

1. Connect the electrode lead and ECG connection cord so that their white panels face the same side.



2. Connect the ECG connection cord to the ECG/RESP socket on the monitor.

When connecting the 3-electrode lead


TEMP
CO_2
RESP
PRESS 2
PRESS 1
SpO_2
NIBP
ECG
RESP

Attaching Disposable Electrodes to the Patient

NOTE

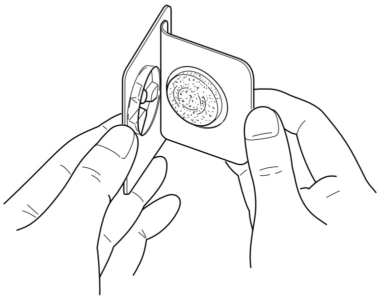
- **To maintain good contact between the electrode and skin, check that the paste of the disposable electrode is not dry.**
- **When contact of the disposable electrode becomes poor, replace the electrode with a new one immediately. Otherwise, contact impedance between the skin and electrode increases and the correct ECG cannot be obtained.**
- **If the contact is bad before the expiration date on the package, replace the electrode with a new one.**

1. Shave excess hair. With a piece of cotton pad moistened with alcohol, clean the patient’s skin where the electrodes should be mounted. Avoid wrinkled or uneven skin areas. Wipe off the alcohol with a dry cotton pad.

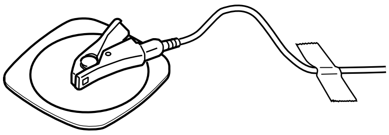
NOTE

To obtain a stable ECG waveform rub the skin with “skinPure” skin preparation gel or tincture of Benzoin.

2. Open the electrode package and take out the electrode.



3. Remove the backing paper from the electrode. Be careful not to touch the adhesive side.
4. Attach the disposable electrode to the previously cleaned skin. Avoid wrinkled and uneven skin areas.
5. Clip the electrode lead which is connected to the monitor onto the electrode.



6. Fasten the electrode lead to the skin with surgical tape with an extra length of wire between the tape and the electrode. This prevents body movement from moving the electrode lead.

Monitoring ECG

When electrodes are attached to the patient and cables are connected properly, ECG appears on the screen.

When using 3 electrodes, one lead appears on the screen. ECG is cascaded. When using 6 electrodes, two leads appear on the monitoring screen.

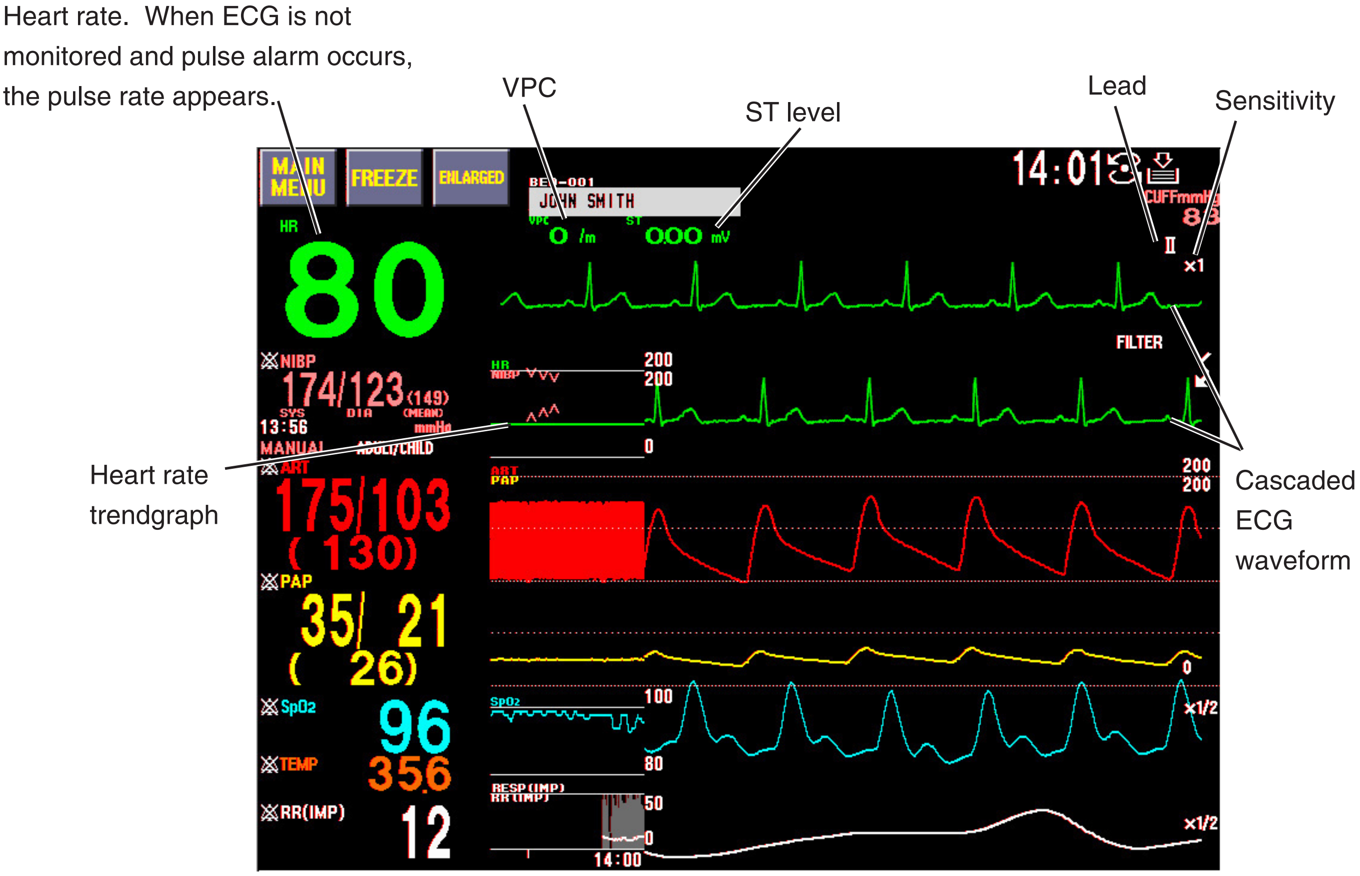
CAUTION

- **When the "CHECK ELECTRODES" message is displayed, ECG cannot be monitored and the ECG alarm does not function. Check the electrodes, electrode leads and connection cord and if necessary, replace it with a new one.**
- **At the start of ECG monitoring, check that the dominant QRS is appropriate. Otherwise arrhythmia monitoring may be inaccurate.**

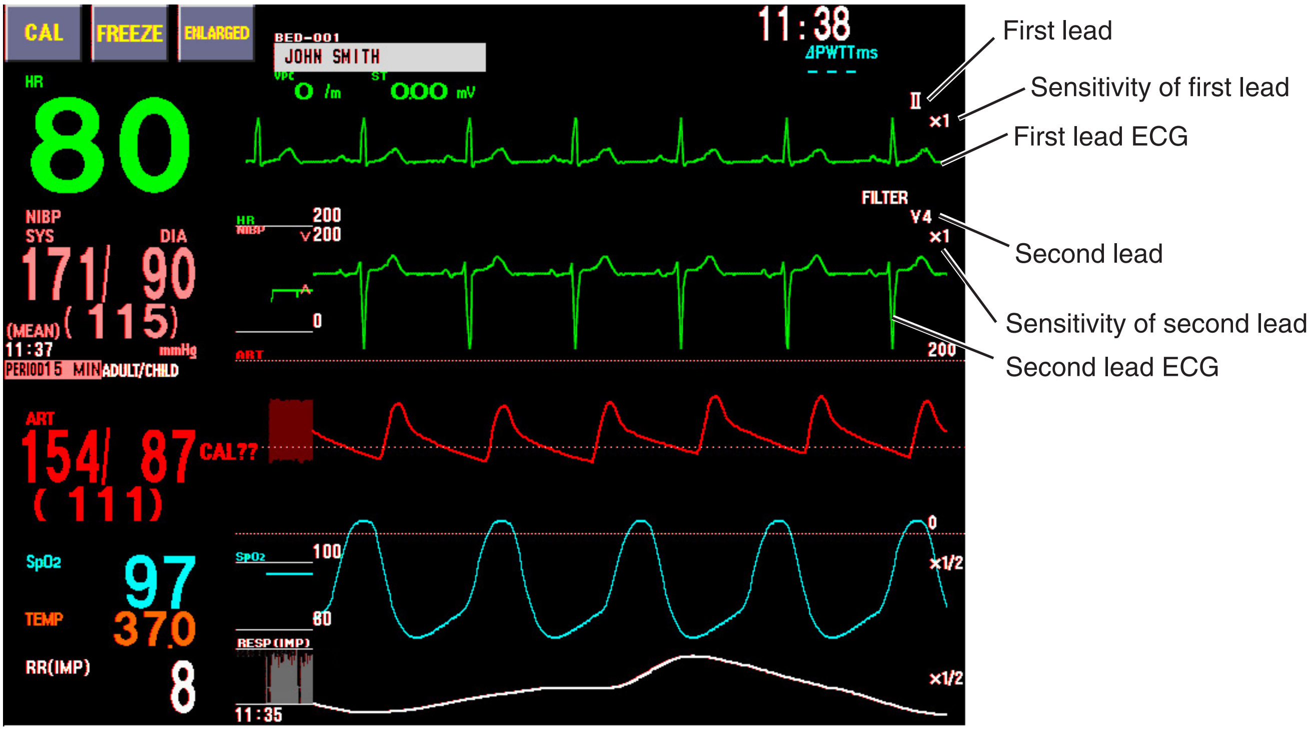
For error messages and monitoring problems, refer to Section 17.

ECG Information on the Monitoring Screen

When monitoring with 3 electrodes


Heart rate. When ECG is not monitored and pulse alarm occurs, the pulse rate appears.
VPC
ST level
Lead
Sensitivity
Heart rate trendgraph
Cascaded ECG waveform
MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
VPC 0 /m
ST 0.00 mV
14:01
CUFFmmHg
II
×1
HR
80
FILTER
NIBP
174/123 (149)
SYS DIA (MEAN) mmHg
13:56
MANUAL ADULT/CHILD
HR NIBP
200
200
0
ART
175/103
(130)
ART PAP
PAP
35/ 21
(26)
SpO2
96
100
80
×1/2
TEMP
35.6
RR(IMP)
12
RESP(IMP) RR(IMP)
50
0
14:00

When monitoring with 6 electrodes

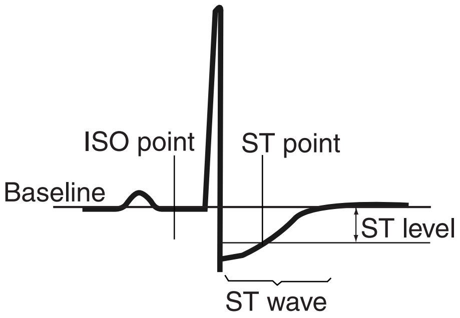

CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
11:38
ΔPWTTms
HR
80
VPC
0 /m
ST
0.00 mV
II
×1
FILTER
V4
×1
NIBP
SYS
DIA
171/ 90
(MEAN) (115)
11:37
mmHg
PERIOD15 MIN
ADULT/CHILD
HR
NIBP
200
200
0
ART
200
ART
154/ 87
CAL??
(111)
0
SpO2
97
TEMP
37.0
RR(IMP)
8
SpO2
100
80
×1/2
RESP(IMP)
×1/2
11:35
First lead
Sensitivity of first lead
First lead ECG
Second lead
Sensitivity of second lead
Second lead ECG

Measuring ST Level

The ST level is the amplitude between the baseline and ST wave. The ECG waveform is averaged for 15 seconds to remove artifacts. The baseline and the ST wave are detected from the averaged ECG, and the ST level is measured.

NOTE

If there are too many arrhythmias or noise superimposed on the ECG, or the heart rate is below 32, ST level measurement may not be performed and ST level is not displayed on the screen.


ISO point
ST point
Baseline
ST level
ST wave

Monitoring Arrhythmia

The following functions are available for arrhythmia monitoring.

- Arrhythmia alarm indication (alarm sound, screen message and alarm indicator lamp). See Section 6.
- Arrhythmia waveform storage. See Section 7.
- Arrhythmia waveform recording. See Section 7.
- VPC rate/min display and trendgraph. See Sections 5 and 7.

WARNING

ARRHYTHMIA ANALYSIS on the ECG OTHER SETTING window must be set to ON when arrhythmia monitoring is necessary. If arrhythmia detection is turned OFF, there is no arrhythmia alarms. When arrhythmia detection is set to off, the "ARRHYTHMIA ANALYSIS OFF" message appears on the screen.

When arrhythmia detection is set to on, arrhythmia detection starts as soon as the ECG monitoring starts. The dominant QRS displayed on the ECG window is used for analyzing arrhythmia. If the following points of a QRS do not match with the dominant QRS, that QRS is recognized as an arrhythmia.

- RR interval
- QRS width
- QRS amplitude
- QRS polarity

CAUTION

If there is any doubt about the arrhythmia analysis, make the monitor relearn the patient's VPC and check that the dominant QRS is appropriate. Otherwise, arrhythmia monitoring may not be accurate.

The following classification messages are displayed on the screen.

Arrhythmia Analysis Classification Messages

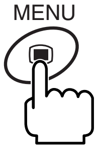
Alarm Name	Description	Displayed Time (s)
ASYSTOLE	Longer than 3 to 10 seconds (selectable) with no QRS complex.	30
VF	Ventricular fibrillation.	
VT	Ventricular tachycardia. 9 or more consecutive VPCs.	
VPC RUN	VPC short run. 3 to 8 (selectable) consecutive VPCs.	20
COUPLET	VPC couplet (paired VPCs). 2 consecutive VPCs.	
EARLY VPC	Early VPC. VPC with a time interval from the preceding normal QRS complex of less than approx. one-third of the normal R-R interval.	
BIGEMINY	Ventricular bigeminy. 3 or more consecutive pairs of VPC and normal QRS.	10
FREQ VPC	Frequent VPCs. VPC rate (VPCs/min) reaching or exceeding the preset limit of 1 to 50 VPCs/min (selectable).	
TACHYCARDIA	Tachycardia. Exceeding the upper heart rate limit.	
BRADYCARDIA	Bradycardia. Dropping below the lower heart rate limit.	

Turning Arrhythmia Analysis On/Off

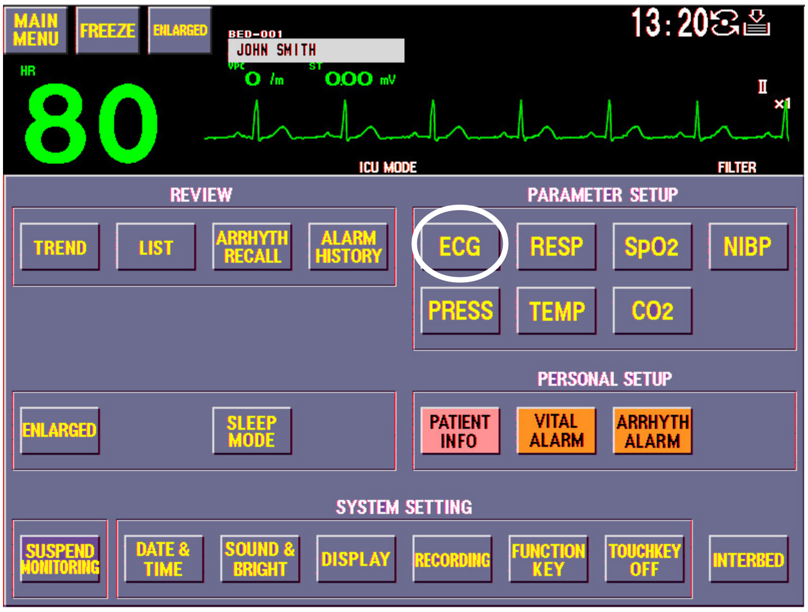
WARNING

This setting must be set to ON when arrhythmia analysis is necessary. If arrhythmia analysis is turned off, there are no arrhythmia alarms.

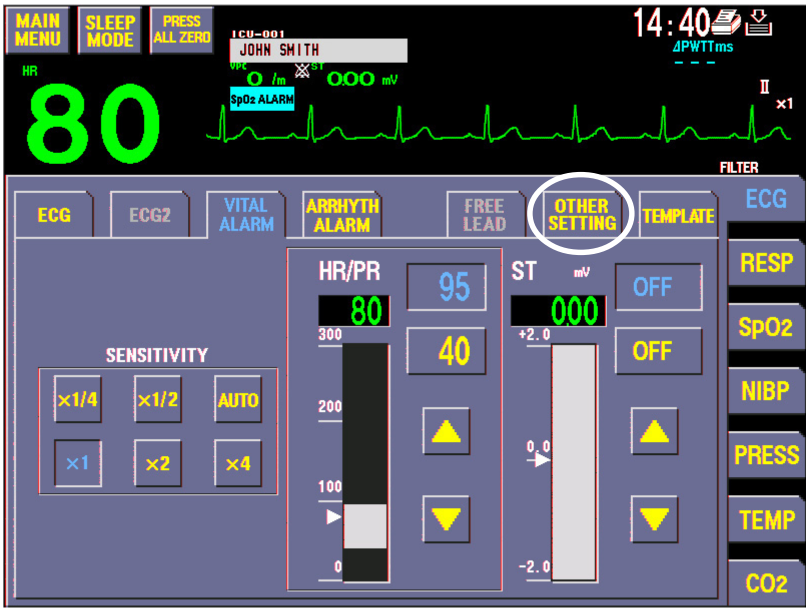
When arrhythmia monitoring is necessary, select ON.



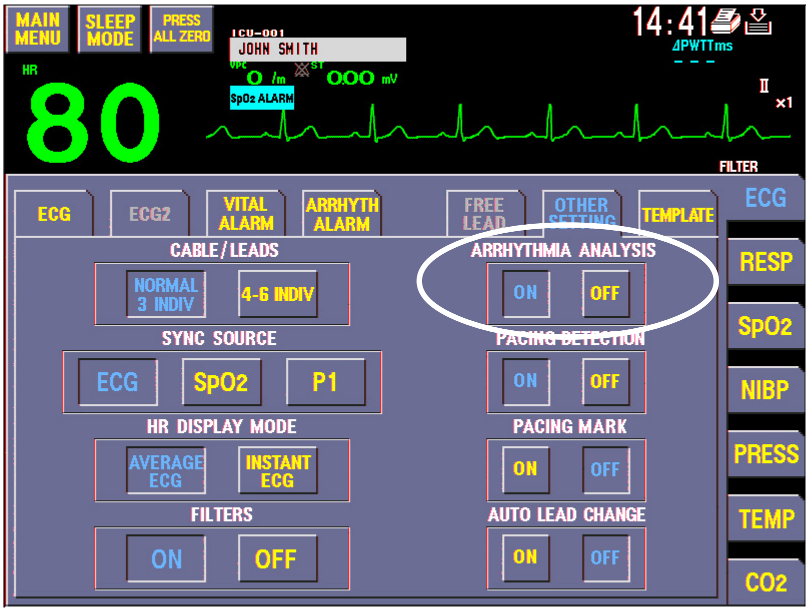
1. Press the MENU key on the front panel to display the MENU window.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC 0 /m
ST 0.00 mV
II
×1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

2. Touch the “ECG” key. The ECG VITAL ALARM window appears.

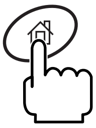

MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
14:40
ΔPWTTms
HR
80
VPC 0 /m
ST 0.00 mV
SpO2 ALARM
II
×1
FILTER
ECG
ECG2
VITAL ALARM
ARRHYTH ALARM
FREE LEAD
OTHER SETTING
TEMPLATE
HR/PR
80
95
40
300
200
100
0
ST
mV
000
OFF
OFF
+2.0
0.0
-2.0
SENSITIVITY
×1/4
×1/2
AUTO
×1
×2
×4
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2

3. Touch the “OTHER SETTING” tab to display the OTHER SETTING window.


MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
14:41
HR
80
SpO2 ALARM
FILTER
ECG
ECG2
VITAL ALARM
ARRHYTH ALARM
FREE LEAD
OTHER SETTING
TEMPLATE
CABLE/LEADS
NORMAL 3 INDIV
4-6 INDIV
SYNC SOURCE
ECG
SpO2
P1
HR DISPLAY MODE
AVERAGE ECG
INSTANT ECG
FILTERS
ON
OFF
ARRHYTHMIA ANALYSIS
ON
OFF
PACING DETECTION
ON
OFF
PACING MARK
ON
OFF
AUTO LEAD CHANGE
ON
OFF
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2

4. Touch the “ON” or “OFF” key in the ARRHYTHMIA ANALYSIS box to turn arrhythmia analysis on or off.

HOME



5. Press the HOME key on the front panel to return to a monitoring screen.

Learning the ECG Waveform for Arrhythmia Detection (VPC Learning)

The monitor automatically detects and classifies arrhythmia waveforms when arrhythmia detection is set to on. To do this, the monitor compares each beat of the realtime ECG waveform to a reference ECG waveform (dominant QRS).

The monitor automatically samples this reference waveform when ECG monitoring begins, when the monitoring lead is changed and when the “CHECK ELECTRODES” alarm message is resolved. Sampling the reference waveform is called “Learning”.

Learning takes about 10 seconds. During learning, a “LEARNING” message is displayed on the screen. After learning, the dominant QRS is replaced with the new one and the monitor resumes analyzing the ECG waveforms.

NOTE

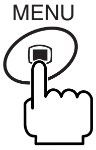
- **To make the monitor learn, ARRHYTHMIA ANALYSIS on the ECG OTHER SETTING window must be set to ON.**
- **During learning, arrhythmia alarms other than ASYSTOLE, BRADYCARDIA and TACHYCARDIA alarms do not function.**

You can make the monitor “relearn” the reference ECG waveform at any time, for example, when the automatic VPC classification is questionable, and change the dominant QRS.

CAUTION

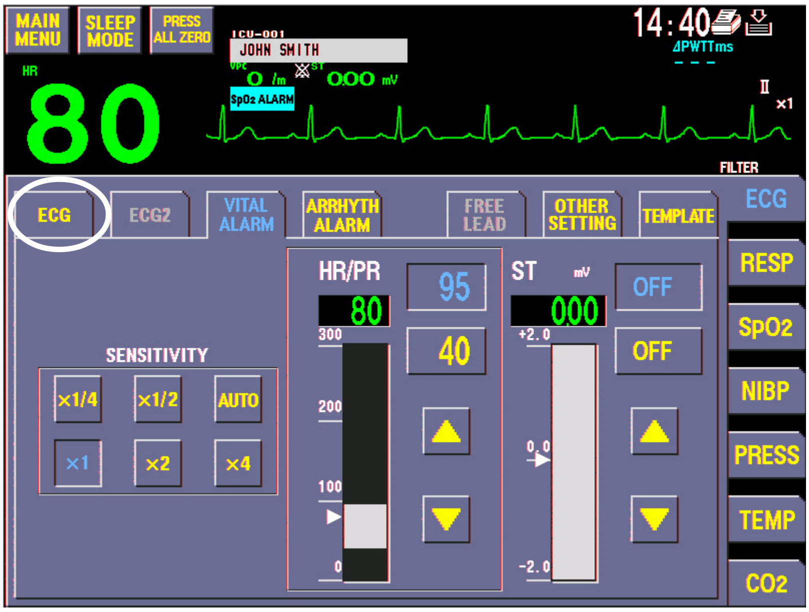
If there is any doubt about the arrhythmia analysis, make the monitor relearn the patient's VPC. Otherwise, an important arrhythmia may be overlooked.

When the QRS wave or RR interval changes too frequently, it becomes difficult for the monitor to distinguish between the normal ECG and arrhythmia. The monitor uses the pattern matching and multi-template matching for analyzing arrhythmia to solve this problem. However, when the patient QRS changes rapidly, check that the appropriate dominant QRS is used for arrhythmia analysis.

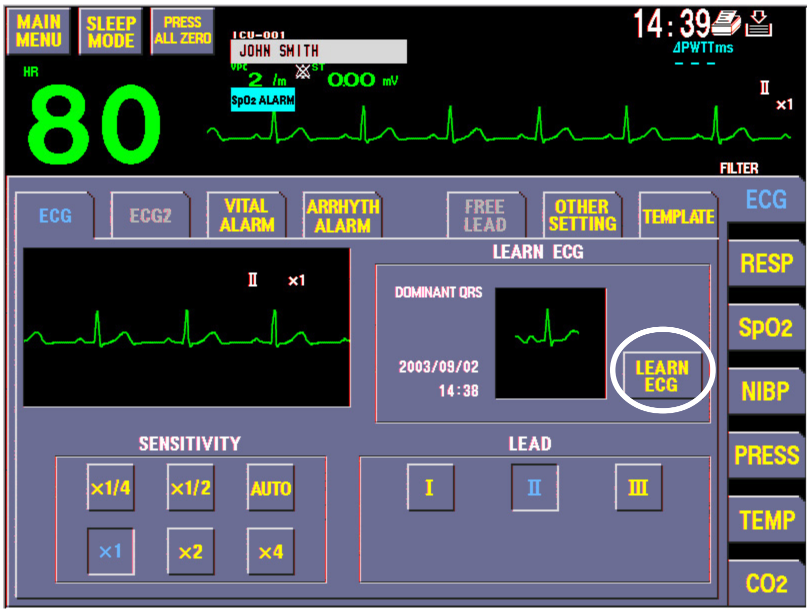


1. Press the MENU key on the front panel to display the MENU window.

2. Touch the "ECG" key. The ECG VITAL ALARM window appears.


MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
VPC
0 /m
ST
0.00 mV
SpO2 ALARM
14:40
ΔPWTTms
HR
80
II
×1
FILTER
ECG
ECG2
VITAL ALARM
ARRHYTH ALARM
FREE LEAD
OTHER SETTING
TEMPLATE
HR/PR
80
95
40
300
200
100
0
ST
mV
0.00
+2.0
0.0
-2.0
OFF
OFF
SENSITIVITY
×1/4
×1/2
AUTO
×1
×2
×4
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2

3. Touch the "ECG" tab on the ECG window.


MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
VPC
2 /m
ST
0.00 mV
SpO2 ALARM
14:39
ΔPWTTms
HR
80
II
×1
FILTER
ECG
ECG2
VITAL ALARM
ARRHYTH ALARM
FREE LEAD
OTHER SETTING
TEMPLATE
II ×1
LEARN ECG
DOMINANT QRS
2003/09/02
14:38
LEARN ECG
SENSITIVITY
×1/4
×1/2
AUTO
×1
×2
×4
LEAD
I
II
III
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2

4. Touch the “LEARN ECG” key on the ECG window. The monitor learns the reference ECG waveform and the dominant QRS is renewed.

5. Check that the dominant QRS is appropriate for arrhythmia analysis.

Changing the Dominant QRS

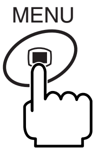
The monitor detects QRS of the monitoring ECG and classifies them into templates. The monitor uses the most typical QRS, called dominant QRS, for analyzing arrhythmia. The four most typical templates are displayed as NORMAL BEATS and the other four QRS which do not match the typical templates are recognized as arrhythmia and displayed as OTHER BEATS on the TEMPLATE window of the ECG window. You can change the dominant QRS with other templates. Whenever ECG is learned or relearned, the dominant QRS and templates are refreshed.

If there is any doubt about the arrhythmia analysis, make the monitor relearn the patient’s VPC and check the dominant QRS.

If there is a normal QRS recognized as OTHER BEATS, such as when monitoring a pacemaker patient, you can move that QRS to the NORMAL BEATS so that the monitor will recognize it as a normal QRS and not as an arrhythmia.

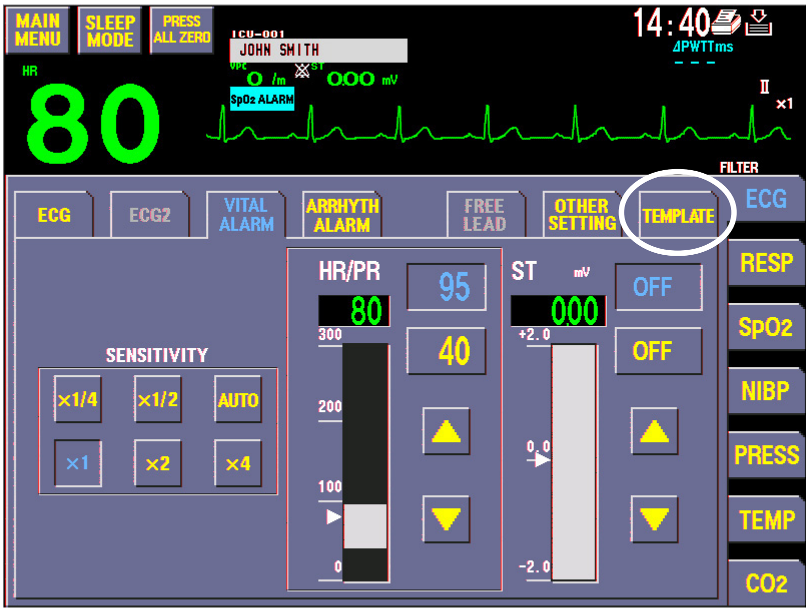
CAUTION

Changing the dominant QRS must be performed under the physician’s instructions.

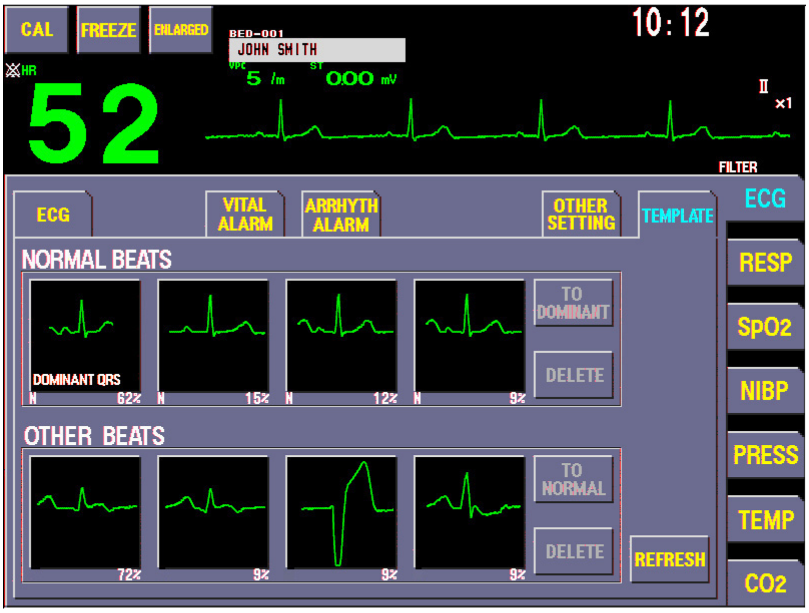


1. Press the MENU key on the front panel to display the MENU window.

2. Touch the “ECG” key. The ECG VITAL ALARM window appears.


MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
14:40
ΔPWTTms
HR
80
VPC
0 /m
ST
0.00 mV
SpO2 ALARM
II
×1
FILTER
ECG
ECG2
VITAL ALARM
ARRHYTH ALARM
FREE LEAD
OTHER SETTING
TEMPLATE
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
HR/PR
80
95
40
300
200
100
0
ST
mV
0.00
+2.0
0.0
-2.0
OFF
OFF
SENSITIVITY
×1/4
×1/2
AUTO
×1
×2
×4

3. Touch the “TEMPLATE” tab on the ECG window.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
10:12
HR
52
VPC
5 /m
ST
0.00 mV
II
x1
FILTER
ECG
VITAL ALARM
ARRHYTH ALARM
OTHER SETTING
TEMPLATE
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
NORMAL BEATS
DOMINANT QRS
N 62%
N 15%
N 12%
N 9%
TO DOMINANT
DELETE
OTHER BEATS
72%
9%
9%
9%
TO NORMAL
DELETE
REFRESH

4. To use another QRS in the NORMAL BEATS as the dominant QRS:
   i) Select the QRS from the NORMAL BEATS box.

   ii) Touch the “TO DOMINANT” key in the NORMAL BEATS box. The message appears confirming the change of dominant QRS.

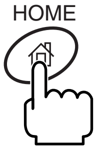
   iii) Touch the “YES” key to change the dominant QRS to the selected QRS.

   iv) Check the dominant QRS on the ECG window.

   To move a QRS from the OTHER BEATS to NORMAL BEATS, select the QRS in the OTHER BEATS box and touch the “TO NORMAL” key.

   To delete a QRS from NORMAL BEATS or OTHER BEATS, select the QRS and touch the “DELETE” key.

   To refresh the setting, touch the “REFRESH” key.



5. Press the HOME key on the front panel to return to a monitoring screen.

Noise Detection and Display

When EMG or body movement noise is superimposed on the ECG waveform during ECG monitoring, a “NOISE” message appears on the screen.

Detached Electrode Detection and Display

When an electrode or electrode lead is detached during ECG monitoring, a highlighted “CHECK ELECTRODES” message appears with a “bong” sounding every 20 seconds and yellow lamp lit.

When monitoring with 6 electrodes and AUTO LEAD CHANGE on the ECG OTHER SETTING window is set to ON, and the “CHECK ELECTRODES” message is displayed for more than 5 seconds, the lead for the first trace on the monitoring screen is automatically changed to a stable lead.

The correct ECG waveform does not appear on the screen while the “CHECK ELECTRODES” message is displayed. Check the electrodes.

Changing ECG Settings

Change settings on the ECG window. The following settings can be changed for ECG monitoring.

- Monitoring lead
- ECG sensitivity
- Heart rate and ST alarm limits
- Arrhythmia alarm setting
- Type of electrode cable and leads
- Sync source
- Arrhythmia analysis on/off. Refer to the “Monitoring Arrhythmia” section.
- Filters on/off
- Heart rate display mode
- Pacing spike detection on/off
- Pacing mark display on/off
- Auto lead change on/off of the first trace when electrode is detached
- Learn ECG. Refer to the “Monitoring Arrhythmia” section.
- Change dominant QRS. Refer to the “Monitoring Arrhythmia” section.

The ECG electrode lead type (IEC or AHA) can be set on the SYSTEM SETUP screen. Refer to Section 3.

Changing the Monitoring Lead

When using 3 electrodes, one lead can be monitored cascaded on the monitoring screen. When using 6 electrodes, two leads can be monitored.

No. of Electrodes	Lead
3	I, II, III
6	I, II, III, aVR, aVL, aVF, Va, Vb

NOTE

When the CABLE/LEADS setting is changed, the lead setting automatically changes to II. Change the type of electrode cable and leads setting before changing the lead.

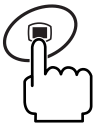
When monitoring with 6 electrodes, the lead of the first trace can be automatically changed to a stable lead when there is an electrode detachment or the “CHECK ELECTRODES” message is displayed for more than 5 seconds. Refer to the “Auto Lead Change On or Off” section.

You can assign the leads for Va and Vb when using 6 electrodes. After assigning the Va and Vb leads, select the monitoring lead. Refer to the “Assigning Va and Vb (Ca and Cb) Leads when Monitoring with 6 Electrodes” section.

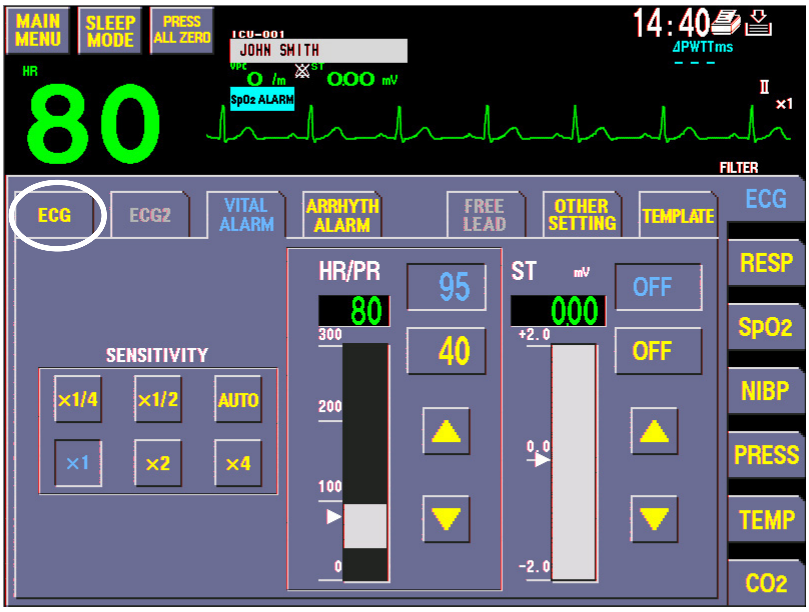
Changing the Lead

1. Press the MENU key on the front panel to display the MENU window.

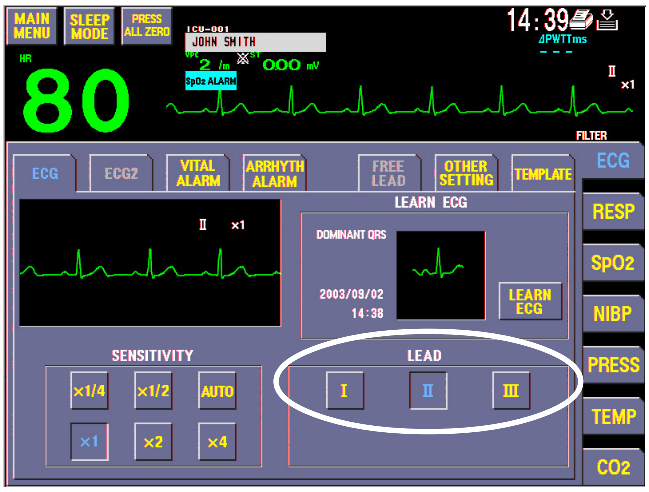
MENU

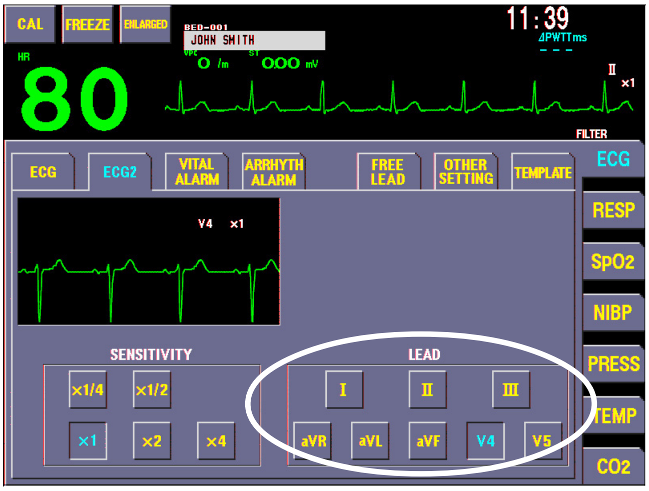


2. Touch the “ECG” key. The ECG VITAL ALARM window appears.


MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
14:40
ΔPWTTms
HR
80
VPC
0 /m
ST
000 mV
SpO2 ALARM
II
×1
FILTER
ECG
ECG2
VITAL ALARM
ARRHYTH ALARM
FREE LEAD
OTHER SETTING
TEMPLATE
SENSITIVITY
×1/4
×1/2
AUTO
×1
×2
×4
HR/PR
80
95
40
300
200
100
0
ST
mV
000
OFF
OFF
+2.0
0.0
-2.0
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2

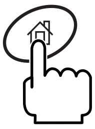
3. Touch the “ECG” tab to change the first lead. Touch the “ECG2” tab to change the second lead (when monitoring with 6 electrodes).


MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
14:39
ΔPWTTms
HR
80
VPC
2 /m
ST
000 mV
SpO2 ALARM
II
×1
FILTER
ECG
ECG2
VITAL ALARM
ARRHYTH ALARM
FREE LEAD
OTHER SETTING
TEMPLATE
LEARN ECG
II ×1
DOMINANT QRS
2003/09/02
14:38
LEARN ECG
SENSITIVITY
×1/4
×1/2
AUTO
×1
×2
×4
LEAD
I
II
III
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
11:39
ΔPWTTms
HR
80
VPC
0 /m
ST
000 mV
II
×1
FILTER
ECG
ECG2
VITAL ALARM
ARRHYTH ALARM
FREE LEAD
OTHER SETTING
TEMPLATE
V4 ×1
SENSITIVITY
×1/4
×1/2
×1
×2
×4
LEAD
I
II
III
aVR
aVL
aVF
V4
V5
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2

4. Select the lead by touching the desired lead key in the LEAD box.

HOME



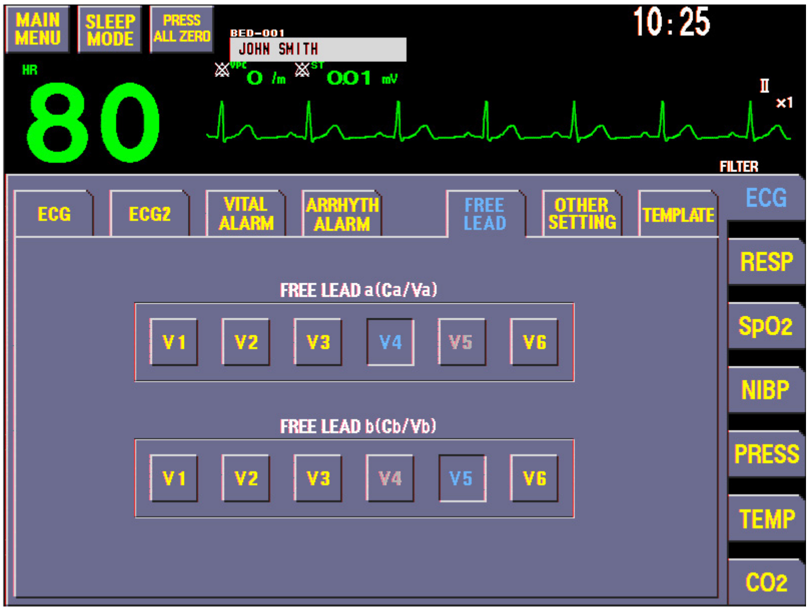
5. Press the HOME key on the front panel to return to the monitoring screen.

Assigning Va and Vb (Ca and Cb) Leads when Monitoring with 6 Electrodes

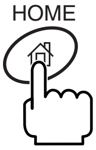
You can assign the leads for Va and Vb when using 6 electrodes. After assigning the Va and Vb leads, select the monitoring lead.

1. Display the ECG window.

2. Touch the “FREE LEAD” tab to display the FREE LEAD window.


MAIN MENU
SLEEP MODE
PRESS ALL ZERO
BED-001
JOHN SMITH
10:25
HR
80
VPC 0 /m
ST 0.01 mV
II
×1
FILTER
ECG
ECG2
VITAL ALARM
ARRHYTH ALARM
FREE LEAD
OTHER SETTING
TEMPLATE
FREE LEAD a(Ca/Va)
V1
V2
V3
V4
V5
V6
FREE LEAD b(Cb/Vb)
V1
V2
V3
V4
V5
V6
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2

3. Select the lead by touching the desired lead key.



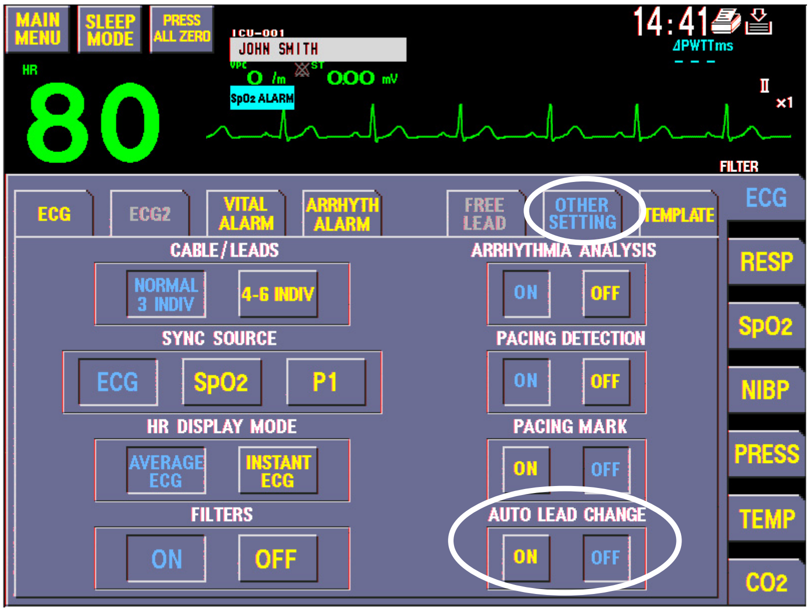
4. Press the HOME key on the front panel to return to the monitoring screen.

Auto Lead Change On or Off

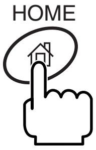
When monitoring with 6 electrodes and AUTO LEAD CHANGE on the ECG OTHER SETTING window is set to ON, the lead for the first trace on the monitoring screen can be automatically changed to a stable lead when there is an electrode detachment or the “CHECK ELECTRODES” message is displayed for more than 5 seconds on the screen. While the “AUTO LEAD CHANGE” message is displayed, the “CHECK ELECTRODES” message is not displayed.

1. Display the ECG window.

2. Touch the “OTHER SETTING” tab to display the OTHER SETTING window.


MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
14:41
ΔPWTTms
- - -
HR
80
VPC 0 /m
ST 0.00 mV
SpO2 ALARM
II
×1
FILTER
ECG
ECG2
VITAL ALARM
ARRHYTH ALARM
FREE LEAD
OTHER SETTING
TEMPLATE
CABLE/LEADS
NORMAL 3 INDIV
4-6 INDIV
SYNC SOURCE
ECG
SpO2
P1
HR DISPLAY MODE
AVERAGE ECG
INSTANT ECG
FILTERS
ON
OFF
ARRHYTHMIA ANALYSIS
ON
OFF
PACING DETECTION
ON
OFF
PACING MARK
ON
OFF
AUTO LEAD CHANGE
ON
OFF
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2

3. Touch the “ON” or “OFF” key in the AUTO LEAD CHANGE box to select on or off.



4. Press the HOME key on the front panel to return to the monitoring screen.

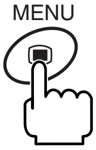
Changing the ECG Sensitivity

The sensitivity determines the size of the waveform on both the screen and recording paper.

The sensitivity can be set manually or automatically. When you select AUTO sensitivity, the sensitivity is automatically determined according to the average QRS amplitude of the previous 16 beats. When sensitivity is set automatically, “AG” (auto gain) appears beside the sensitivity on the screen. When there is noise, AUTO sensitivity is not possible.

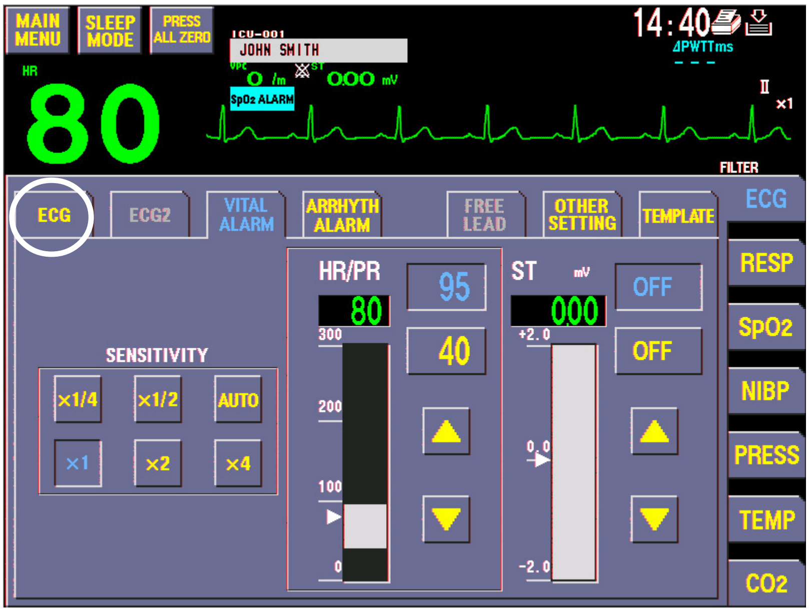
QRS Wave Amplitude	Sensitivity
< 5 mm	× 4
< 10 mm	× 2
< 20 mm	× 1
< 30 mm	× 1/2
≥ 30 mm	× 1/4

For stable QRS detection, select the sensitivity so that the amplitude of the QRS is larger than 1 cm.

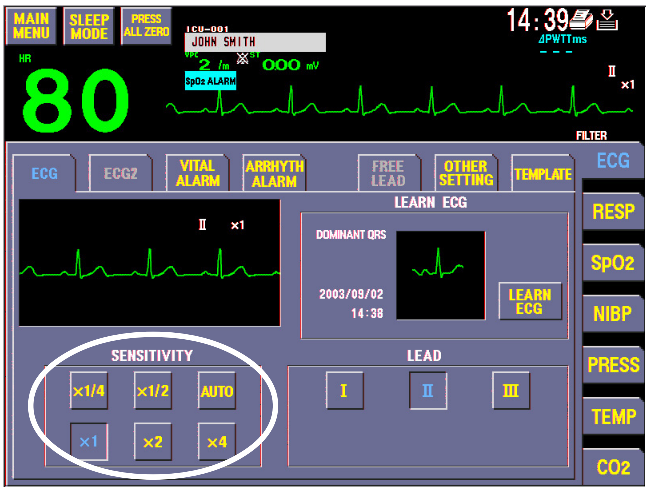


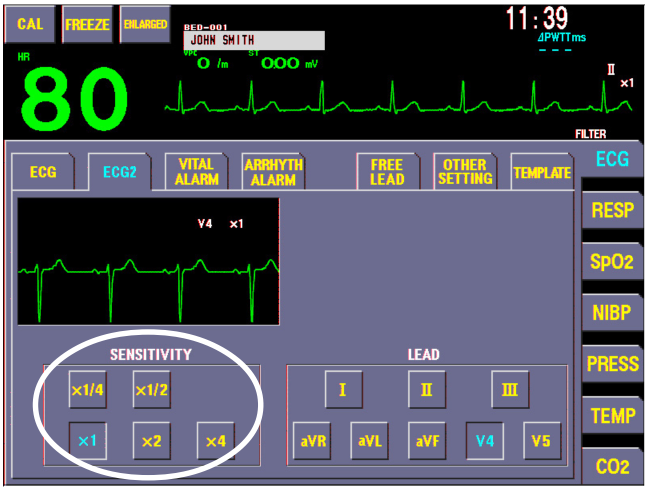
1. Press the MENU key on the front panel to display the MENU window.

2. Touch the “ECG” key. The ECG VITAL ALARM window appears.


MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
14:40
ΔPWTTms
HR
80
VPC
0 /m
ST
000 mV
SpO2 ALARM
II
×1
FILTER
ECG
ECG2
VITAL ALARM
ARRHYTH ALARM
FREE LEAD
OTHER SETTING
TEMPLATE
SENSITIVITY
×1/4
×1/2
AUTO
×1
×2
×4
HR/PR
80
95
40
300
200
100
0
ST
mV
000
OFF
OFF
+2.0
0.0
-2.0
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2

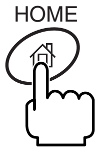
3. Touch the “ECG” tab to change sensitivity for the first lead. Touch the “ECG2” tab to change the sensitivity for the second lead (when monitoring with 6 electrodes).


MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
14:39
ΔPWTTms
HR
80
VPC 2 /m
ST 0.00 mV
SpO2 ALARM
II ×1
FILTER
ECG
ECG2
VITAL ALARM
ARRHYTH ALARM
FREE LEAD
OTHER SETTING
TEMPLATE
LEARN ECG
DOMINANT QRS
2003/09/02 14:38
LEARN ECG
SENSITIVITY
×1/4
×1/2
AUTO
×1
×2
×4
LEAD
I
II
III
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
11:39
ΔPWTTms
HR
80
VPC 0 /m
ST 0.00 mV
II ×1
FILTER
ECG
ECG2
VITAL ALARM
ARRHYTH ALARM
FREE LEAD
OTHER SETTING
TEMPLATE
V4 ×1
SENSITIVITY
×1/4
×1/2
×1
×2
×4
LEAD
I
II
III
aVR
aVL
aVF
V4
V5
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2

4. Select the sensitivity by touching the desired sensitivity in the SENSITIVITY box.

The sensitivity can also be set on the VITAL ALARM window of the ECG window.



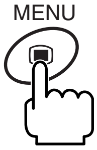
5. Press the HOME key on the front panel to return to the monitoring screen.

Changing the Heart Rate or Pulse Rate and ST Alarm Limits

CAUTION

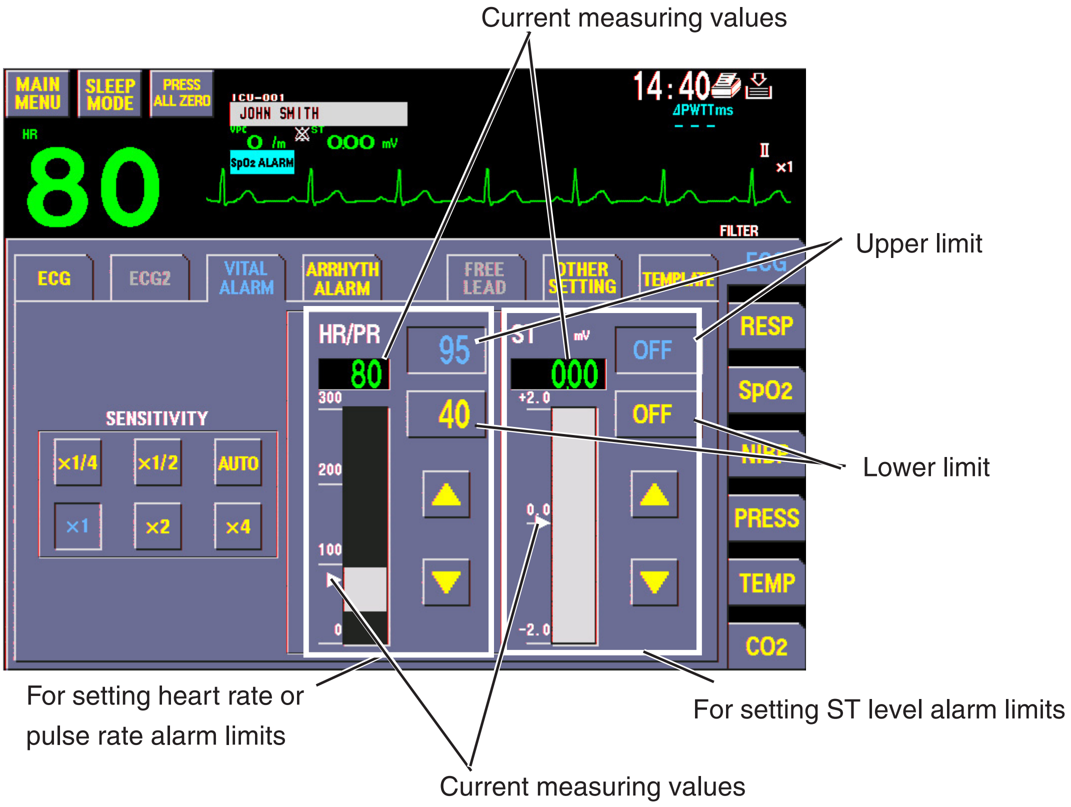
When the upper or lower alarm limit is turned off, there will be no heart rate upper or lower alarm for that limit.

You can set the upper and lower heart rate and ST alarm limits on this window. Other alarm items must be set on the VITAL ALARM window. You can set all alarms, including the upper and lower heart rate and ST alarm limits, on the VITAL ALARM window (See Section 6).



1. Press the MENU key on the front panel to display the MENU window.

2. Touch the “ECG” key. The ECG VITAL ALARM window appears.


Current measuring values
MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
14:40
ΔPWTTms
HR
80
SpO2 ALARM
FILTER
Upper limit
ECG
ECG2
VITAL ALARM
ARRHYTH ALARM
FREE LEAD
OTHER SETTING
TEMPLATE
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
HR/PR
80
95
40
300
200
100
0
ST
mV
0.00
OFF
OFF
+2.0
0.0
-2.0
SENSITIVITY
×1/4
×1/2
AUTO
×1
×2
×4
Lower limit
For setting heart rate or pulse rate alarm limits
For setting ST level alarm limits
Current measuring values

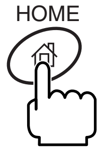
3. Touch the HR/PR alarm setting bar to change the HR/PR alarm setting.

   Touch the ST alarm setting bar to change the ST alarm setting.

4. Touch the upper limit box to set the upper limit or touch the lower limit box to set the lower limit.

5. Touch the desired level on the setting bar. Touch the ▲ or ▼ key to adjust the setting.

   If the upper limit is set to a value above the maximum or the lower limit is set to a value below the minimum, the alarm is set to OFF.



6. Press the HOME key on the front panel to return to the monitoring screen.

Changing the Arrhythmia Alarm Setting

WARNING

For arrhythmia monitoring, set ARRHYTHMIA ANALYSIS on the ECG OTHER SETTING window to ON. Otherwise, there is no sound or indication for arrhythmia alarms.

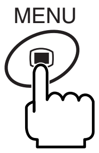
CAUTION

When the alarm is turned OFF for an arrhythmia, there will be no alarm for that arrhythmia type. There is no message or mark to indicate that a certain arrhythmia alarm is turned off, therefore, take care when turning off an arrhythmia alarm.

You can turn on or off the alarm for individual arrhythmia and set threshold for some arrhythmias. The following table shows the setting for each arrhythmia.

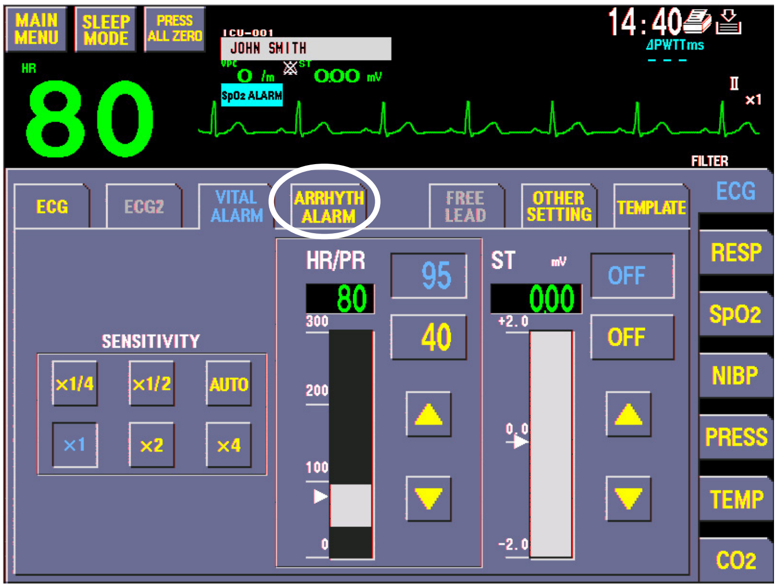
Parameter	Detection Condition (Default Setting)	Alarm ON/OFF Setting
ASYSTOLE	3 to 10 seconds (OR, ICU: 5 s NICU: 3 s)	ON fixed
VF	——	ON fixed
VT	——	ON fixed
VPC RUN	3 to 8 VPCs (3 VPCs)	ON/OFF (OR, NICU: OFF ICU: ON)
COUPLET	——	ON/OFF (OFF)
EARLY V	——	ON/OFF (OFF)
BIGEMINY	——	ON/OFF (OFF)
FREQ VPC	1 to 50 VPCs/min (10 VPCs/min)	ON/OFF (OFF)

The arrhythmia alarms can be set individually or can be set altogether using an arrhythmia alarm master. The arrhythmia alarms can be set on the ARRHYTH ALARM window and on the ARRHYTH ALARM window of the ECG window.

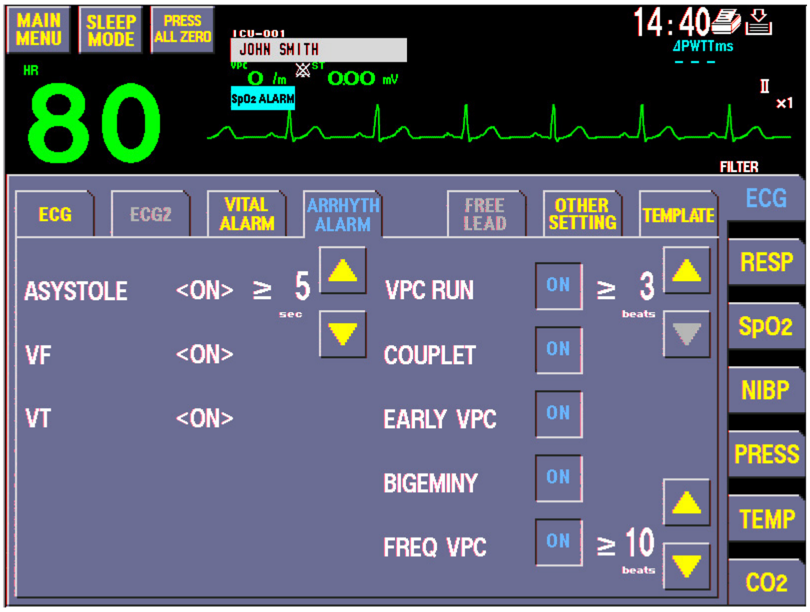


1. Press the MENU key on the front panel to display the MENU window.

2. Touch the “ECG” key. The ECG VITAL ALARM window appears.


MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
14:40
HR
80
SpO2 ALARM
II ×1
FILTER
ECG
ECG2
VITAL ALARM
ARRHYTH ALARM
FREE LEAD
OTHER SETTING
TEMPLATE
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
SENSITIVITY
×1/4
×1/2
AUTO
×1
×2
×4
HR/PR
80
95
40
300
200
100
0
ST mV
000
OFF
OFF
+2.0
0.0
-2.0

3. Touch the “ARRHYTH ALARM” tab to display the ARRHYTH ALARM window.


MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
14:40
ΔPWTTms
HR
80
VPC 0 /m
ST 0.00 mV
SpO2 ALARM
II
×1
FILTER
ECG
ECG2
VITAL ALARM
ARRHYTH ALARM
FREE LEAD
OTHER SETTING
TEMPLATE
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2

ASYSTOLE <ON> ≥ 5 sec

VF <ON>

VT <ON>

VPC RUN ON ≥ 3 beats

COUPLET ON

EARLY VPC ON

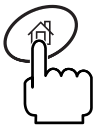
BIGEMINY ON

FREQ VPC ON ≥ 10 beats

4. Touch the “ON” or “OFF” key to set each arrhythmia type on or off.

5. For the ASYSTOLE, VPC RUN and FREQ VPC, set the detecting condition with the ▲ or ▼ key.

HOME



6. Press the HOME key on the front panel to return to the monitoring screen.

Changing the Type of Electrode Cable and Leads

Select the type of electrode cable and leads connected to the monitor.

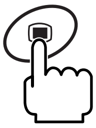
NORMAL 3 INDIV:	For using BR-903PA/913PA or BR-906PA/916PA electrode lead or 3 electrodes with DIN type leads.
4-6 INDIV:	For using 4 to 6 electrodes with DIN type leads. The RF/RL electrode must be attached.

When this setting is changed, the monitoring lead changes to II.

NOTE

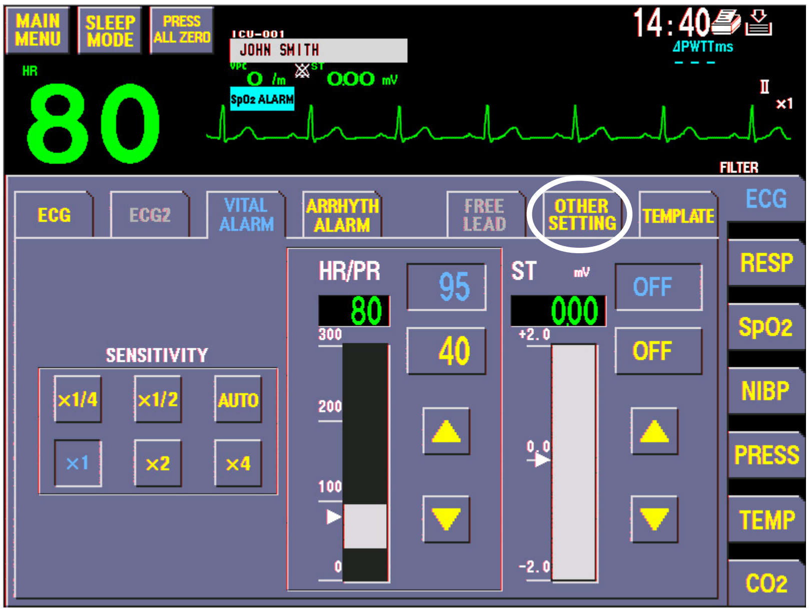
- **If “4-6 INDIV” is selected when monitoring with 3 electrodes, the “CHECK ELECTRODES” message is displayed on the screen and ECG cannot be monitored properly. When monitoring with 3 electrodes, select “NORMAL 3 INDIV”.**
- **The BJ-900PA ECG patient cable and JC-900PA ECG connection cord for 10 electrodes cannot be used.**

MENU

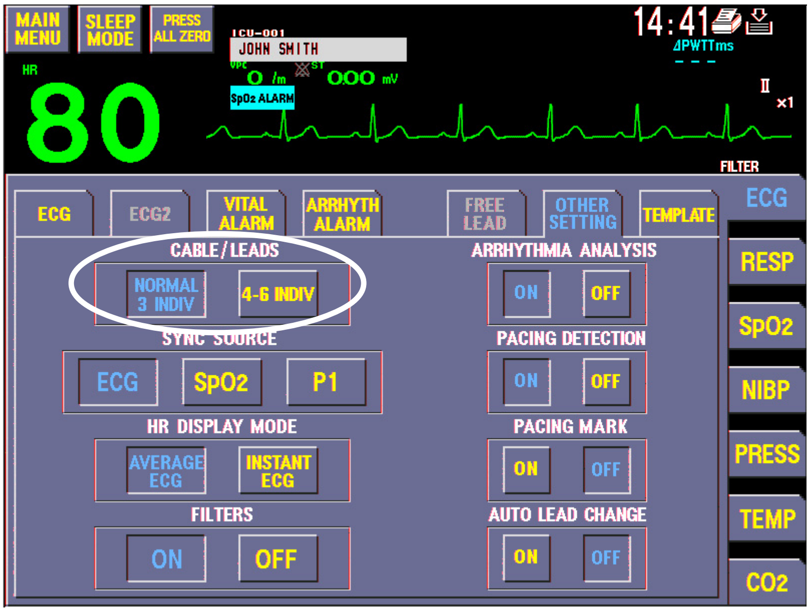


1. Press the MENU key on the front panel to display the MENU window.

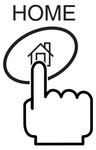
2. Touch the “ECG” key. The ECG VITAL ALARM window appears.


MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
14:40
ΔPWTTms
HR
80
SpO2 ALARM
FILTER
ECG
ECG2
VITAL ALARM
ARRHYTH ALARM
FREE LEAD
OTHER SETTING
TEMPLATE
RESP
SpO2
NIBP
PRESS
TEMP
CO2
SENSITIVITY
×1/4
×1/2
AUTO
×1
×2
×4
HR/PR
95
40
ST
OFF
OFF

3. Touch the “OTHER SETTING” tab to display the OTHER SETTING window.


MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
14:41
ΔPWTTms
HR
80
SpO2 ALARM
FILTER
ECG
ECG2
VITAL ALARM
ARRHYTH ALARM
FREE LEAD
OTHER SETTING
TEMPLATE
CABLE/LEADS
NORMAL 3 INDIV
4-6 INDIV
SYNC SOURCE
ECG
SpO2
P1
HR DISPLAY MODE
AVERAGE ECG
INSTANT ECG
FILTERS
ON
OFF
ARRHYTHMIA ANALYSIS
ON
OFF
PACING DETECTION
ON
OFF
PACING MARK
ON
OFF
AUTO LEAD CHANGE
ON
OFF
RESP
SpO2
NIBP
PRESS
TEMP
CO2

4. Select “NORMAL 3 INDIV” or “4-6 INDIV” from the CABLE/LEADS box.



5. Press the HOME key on the front panel to return to the monitoring screen.

Changing the Sync Source

You can select ECG, SpO_2 pulse (SpO_2) or arterial blood pressure pulse (P1) as the sync source.

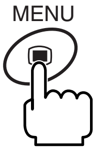
When pulse wave and pressure waveform are irregular because of an IABP, select ECG.

NOTE

- **When heart rate is unstable because of an electrosurgical unit, select SpO_2 or P1.**
- **When the connection cord of SpO_2 or IBP is disconnected from the monitor and alarm occurs when the sync source is set to SpO_2 or P1, the sync source changes to ECG when the alarm is silenced by pressing the SILENCE ALARMS key. The sync source returns to SpO_2 or P1 when the SpO_2 or IBP is monitored again.**
- **When the sensor is detached from the patient and alarm occurs, and the sync source is set to SpO_2 or P1, the sync source does not change to ECG when the alarm is silenced and PR is displayed "- - - ".**
- **On BSM-2304, to use P1 as the sync source, the IBP must be monitored by the PRESS1 socket.**

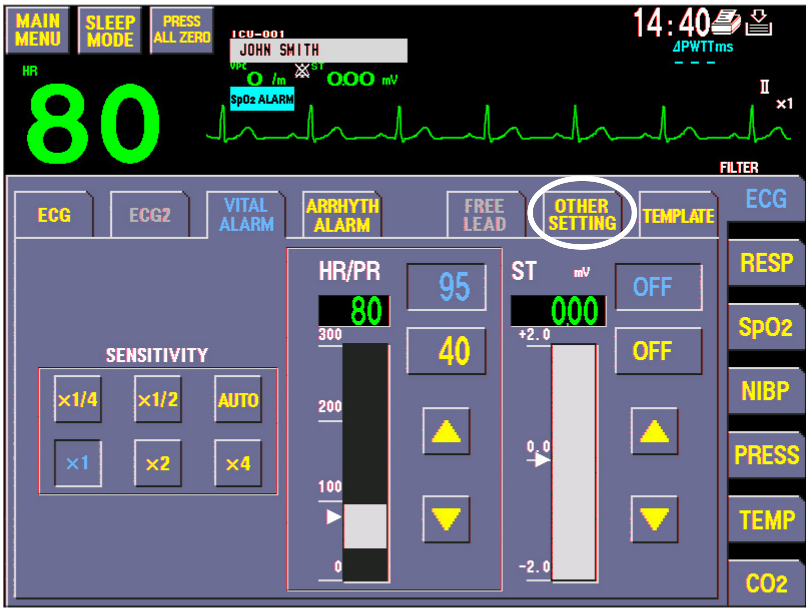
When the sync source is set to ECG and ECG is not measured, there is no sync sound.

When SpO_2 or P1 is selected, the pulse rate is displayed instead of the heart rate on the screen.

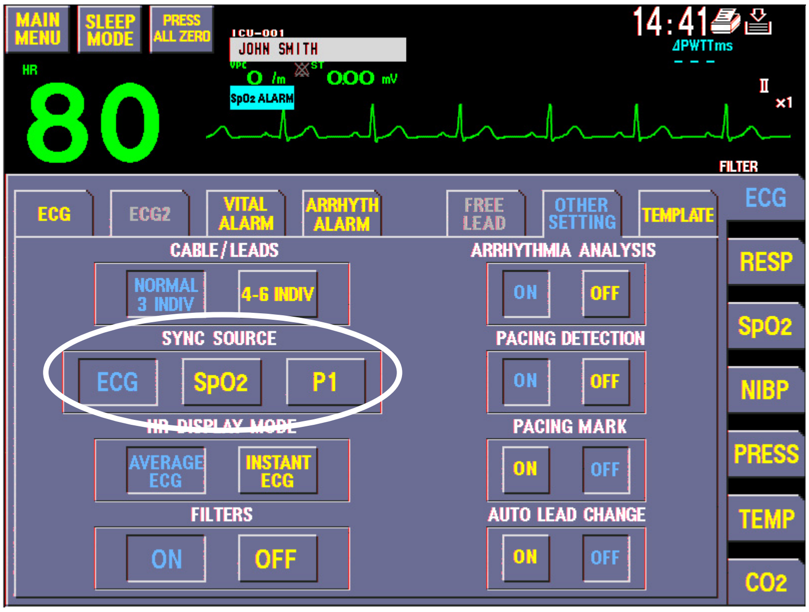


1. Press the MENU key on the front panel to display the MENU window.

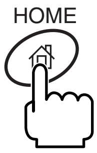
2. Touch the "ECG" key. The ECG VITAL ALARM window appears.


MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
14:40
ΔPWTTms
HR
80
VPC
0 /m
ST
0.00 mV
SpO2 ALARM
II
×1
FILTER
ECG
ECG2
VITAL ALARM
ARRHYTH ALARM
FREE LEAD
OTHER SETTING
TEMPLATE
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
SENSITIVITY
×1/4
×1/2
AUTO
×1
×2
×4
HR/PR
80
95
40
300
200
100
0
ST
mV
000
+2.0
0.0
-2.0
OFF
OFF

3. Touch the "OTHER SETTING" tab to display the OTHER SETTING window.


MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
14:41
ΔPWTTms
HR
80
VPC 0 /m
ST 0.00 mV
SpO2 ALARM
II
×1
FILTER
ECG
ECG2
VITAL ALARM
ARRHYTH ALARM
FREE LEAD
OTHER SETTING
TEMPLATE
CABLE/LEADS
NORMAL 3 INDIV
4-6 INDIV
SYNC SOURCE
ECG
SpO2
P1
HR DISPLAY MODE
AVERAGE ECG
INSTANT ECG
FILTERS
ON
OFF
ARRHYTHMIA ANALYSIS
ON
OFF
PACING DETECTION
ON
OFF
PACING MARK
ON
OFF
AUTO LEAD CHANGE
ON
OFF
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2

4. Touch the “ECG”, “SpO$_2$” or “P1” key in the SYNC SOURCE box to select the sync source.

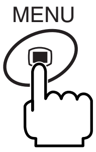


5. Press the HOME key on the front panel to return to the monitoring screen.

Turning the Filters On/Off

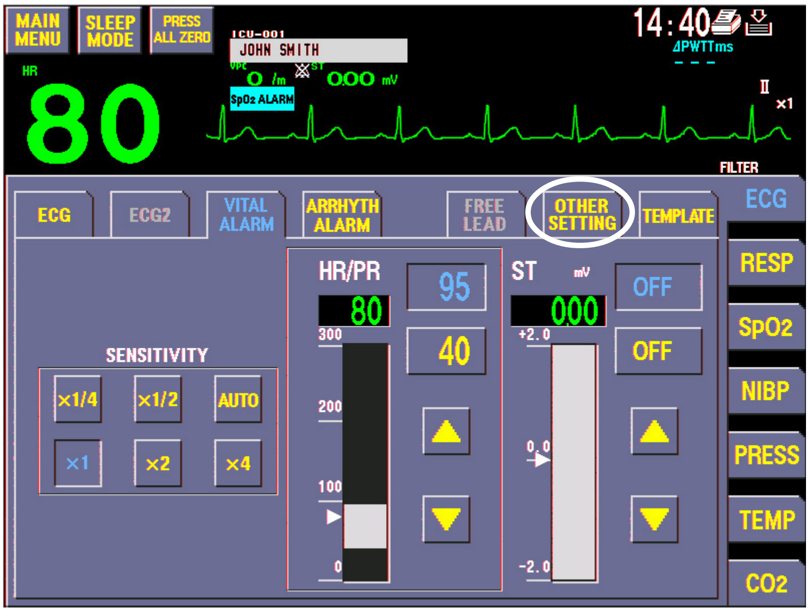
When “ON” is selected, the hum filter automatically reduces AC interference from the ECG, and the low cut filter prevents ECG baseline drift. The hum filter reduces the QRS amplitude of a normal healthy person to about 80%. The low cut filter suppresses the ECG baseline drift but the waveform is slightly distorted because low frequency components are removed from the ECG signal.

Baseline drift is usually caused by unstable electrode contact which is caused by sweat, body movement, or electrode lead movement. To prevent electrode lead movement caused by body movement, fasten the electrode lead to the skin with surgical tape with an extra length of wire between the tape and the electrode.

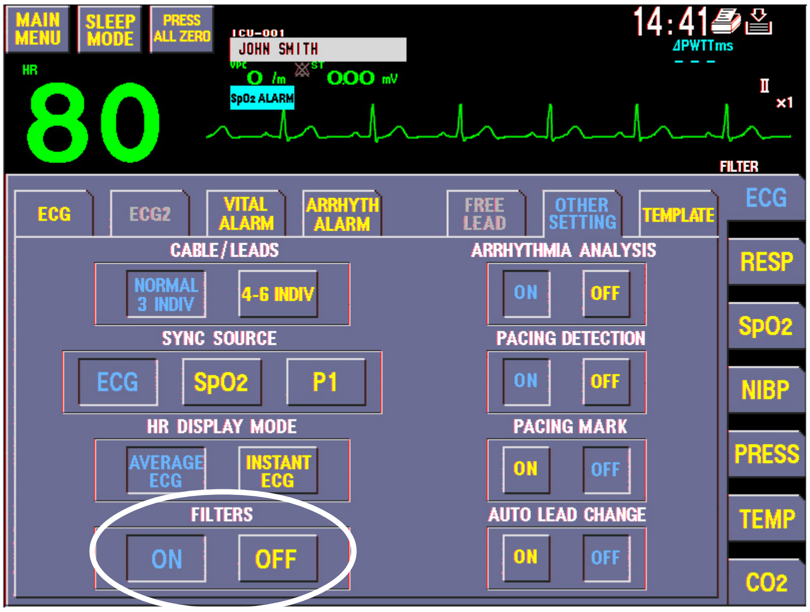


1. Press the MENU key on the front panel to display the MENU window.

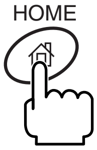
2. Touch the “ECG” key. The ECG VITAL ALARM window appears.


MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
14:40
ΔPWTTms
HR
80
SpO2 ALARM
0.00 mV
II
×1
FILTER
ECG
ECG2
VITAL ALARM
ARRHYTH ALARM
FREE LEAD
OTHER SETTING
TEMPLATE
SENSITIVITY
×1/4
×1/2
AUTO
×1
×2
×4
HR/PR
95
80
40
300
200
100
0
ST
mV
0.00
OFF
OFF
+2.0
0.0
-2.0
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2

3. Touch the “OTHER SETTING” tab to display the OTHER SETTING window.


MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
14:41
ΔPWTTms
HR
80
SpO2 ALARM
0.00 mV
II
×1
FILTER
ECG
ECG2
VITAL ALARM
ARRHYTH ALARM
FREE LEAD
OTHER SETTING
TEMPLATE
CABLE/LEADS
NORMAL 3 INDIV
4-6 INDIV
SYNC SOURCE
ECG
SpO2
P1
HR DISPLAY MODE
AVERAGE ECG
INSTANT ECG
FILTERS
ON
OFF
ARRHYTHMIA ANALYSIS
ON
OFF
PACING DETECTION
ON
OFF
PACING MARK
ON
OFF
AUTO LEAD CHANGE
ON
OFF
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2

4. Touch the “ON” or “OFF” key in the FILTERS box to set the filters on or off.

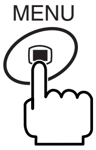


5. Press the HOME key on the front panel to return to the monitoring screen.

Selecting the Mode for Updating the Heart Rate

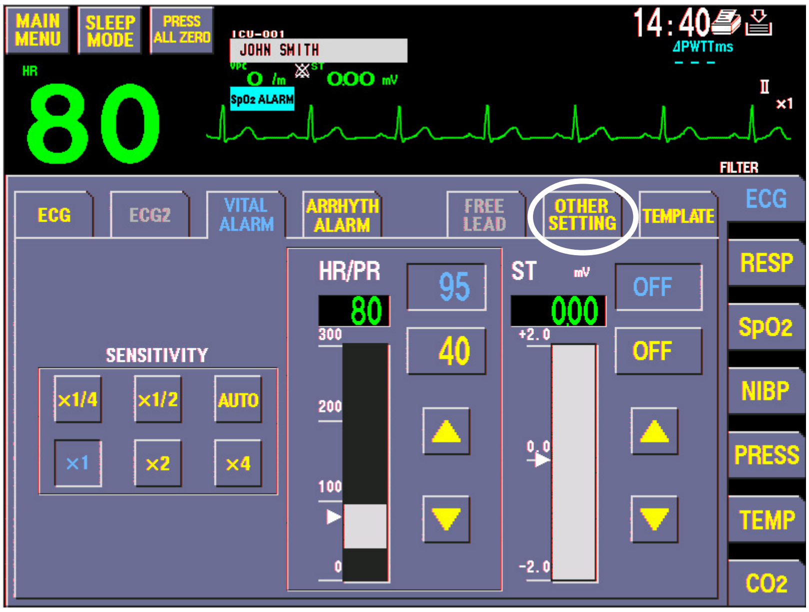
There are two calculation modes, “AVERAGE ECG” and “INSTANT ECG”.

AVERAGE ECG:	The heart rate is calculated by a moving average. The monitor detects 8 consecutive beats including VPC, averages the R-R intervals of the latest 8 beats and uses this average to calculate the current heart rate. When a new beat is detected, the heart rate is recalculated using the latest 8 beats. The heart rate display is updated every 3 seconds.
INSTANT ECG:	The heart rate is calculated based on the latest 2 beats. The heart rate display is updated every 3 seconds.

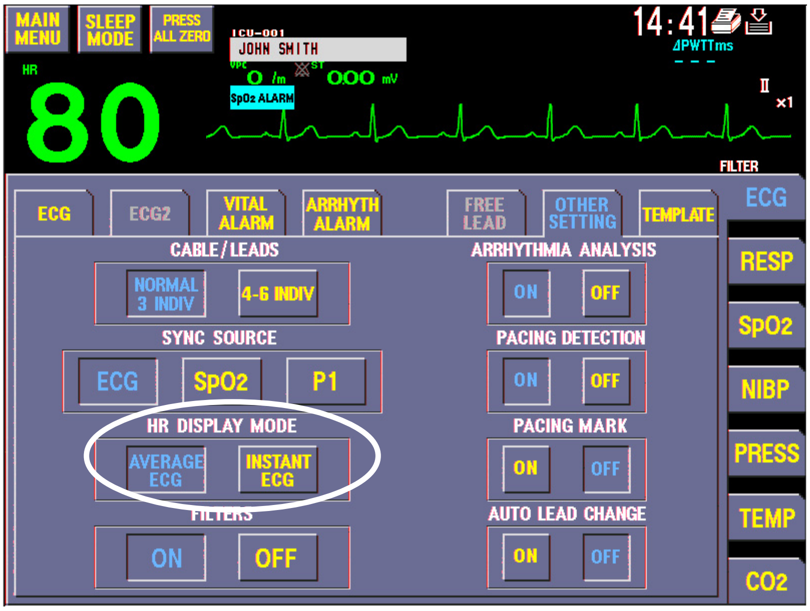


1. Press the MENU key on the front panel to display the MENU window.

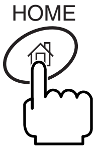
2. Touch the “ECG” key. The ECG VITAL ALARM window appears.


MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
14:40
ΔPWTTms
HR
80
VPC 0 /m
ST 0.00 mV
SpO2 ALARM
II ×1
FILTER
ECG
ECG2
VITAL ALARM
ARRHYTH ALARM
FREE LEAD
OTHER SETTING
TEMPLATE
SENSITIVITY
×1/4
×1/2
AUTO
×1
×2
×4
HR/PR
80
95
40
300
200
100
0
ST
mV
0.00
OFF
OFF
+2.0
0.0
-2.0
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2

3. Touch the “OTHER SETTING” tab to display the OTHER SETTING window.


MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
14:41
ΔPWTTms
HR
80
VPC 0 /m
ST 0.00 mV
SpO2 ALARM
II ×1
FILTER
ECG
ECG2
VITAL ALARM
ARRHYTH ALARM
FREE LEAD
OTHER SETTING
TEMPLATE
CABLE/LEADS
NORMAL 3 INDIV
4-6 INDIV
SYNC SOURCE
ECG
SpO2
P1
HR DISPLAY MODE
AVERAGE ECG
INSTANT ECG
FILTERS
ON
OFF
ARRHYTHMIA ANALYSIS
ON
OFF
PACING DETECTION
ON
OFF
PACING MARK
ON
OFF
AUTO LEAD CHANGE
ON
OFF
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2

4. Touch the “AVERAGE ECG” or “INSTANT ECG” key in the HR DISPLAY MODE box.



5. Press the HOME key on the front panel to return to the monitoring screen.

Turning Pacing Spike Detection On/Off

When the patient has an implanted cardiac pacemaker, set this to ON to detect pacemaker spike and allow correct heart rate counting.

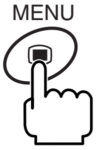
When you monitor a premature baby or infant and the monitor miscounts the narrow width QRS, set this to Off.

WARNING

- **False low heart rate indicators or false asystole calls may occur with certain pacemakers because of electrical overshoots.**
- **Pacemaker patients can only be monitored when the pace program is active.**
- **Keep pacemaker patients under close observation. The pacemaker rate may be counted during cardiac arrest and certain arrhythmias. Do not rely only on the monitor.**

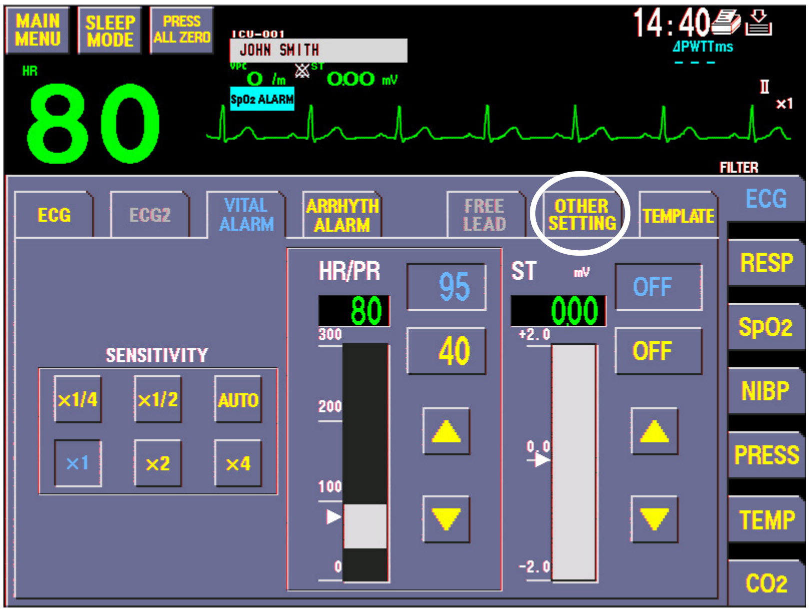
CAUTION

Turn the pacing spike detection to ON when monitoring a pacemaker patient. Otherwise QRS and pacemaker spike may not be distinguished and pacemaker failure may not be recognized.

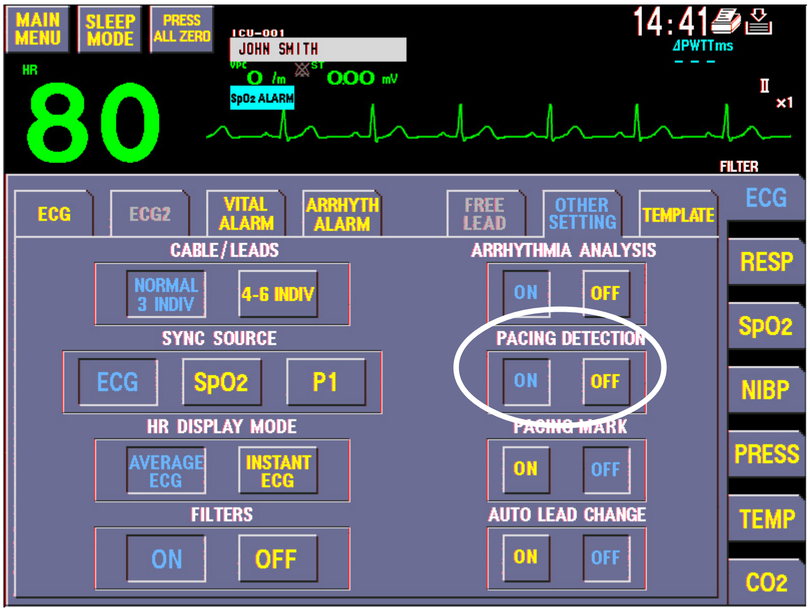


1. Press the MENU key on the front panel to display the MENU window.

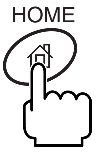
2. Touch the “ECG” key. The ECG VITAL ALARM window appears.


MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
14:40
HR
80
SpO2 ALARM
FILTER
ECG
ECG2
VITAL ALARM
ARRHYTH ALARM
FREE LEAD
OTHER SETTING
TEMPLATE
SENSITIVITY
×1/4
×1/2
AUTO
×1
×2
×4
HR/PR
95
80
40
ST
0.00
OFF
OFF
RESP
SpO2
NIBP
PRESS
TEMP
CO2

3. Touch the “OTHER SETTING” tab to display the OTHER SETTING window.


MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
14:41
HR
80
FILTER
ECG
ECG2
VITAL ALARM
ARRHYTH ALARM
FREE LEAD
OTHER SETTING
TEMPLATE
CABLE/LEADS
NORMAL 3 INDIV
4-6 INDIV
SYNC SOURCE
ECG
SpO2
P1
HR DISPLAY MODE
AVERAGE ECG
INSTANT ECG
FILTERS
ON
OFF
ARRHYTHMIA ANALYSIS
ON
OFF
PACING DETECTION
ON
OFF
PACING MARK
ON
OFF
AUTO LEAD CHANGE
ON
OFF
RESP
SpO2
NIBP
PRESS
TEMP
CO2

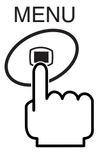
4. Touch the “ON” or “OFF” key in the PACING DETECTION box to select on or off.



5. Press the HOME key on the front panel to return to the monitoring screen.

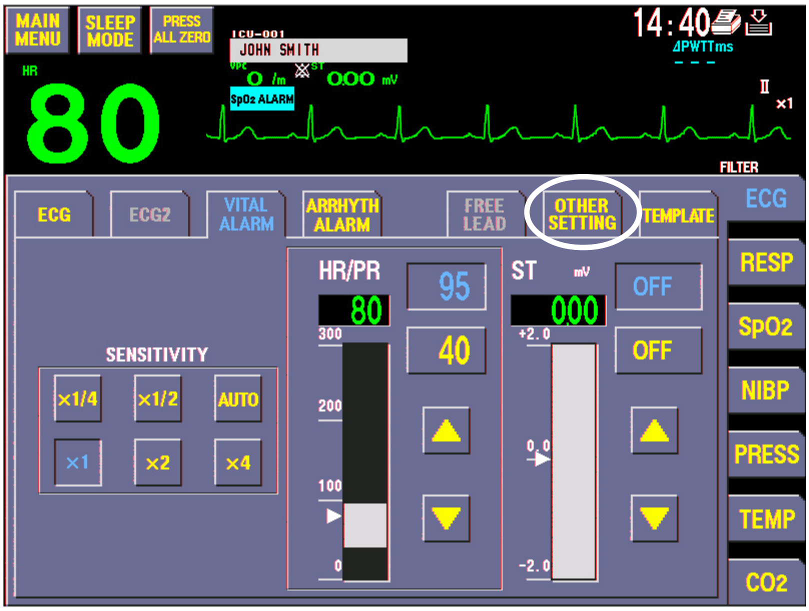
Displaying the Pacing Mark on the ECG

When "PACING DETECTION" is set to ON, the pacing mark can be displayed on the ECG.

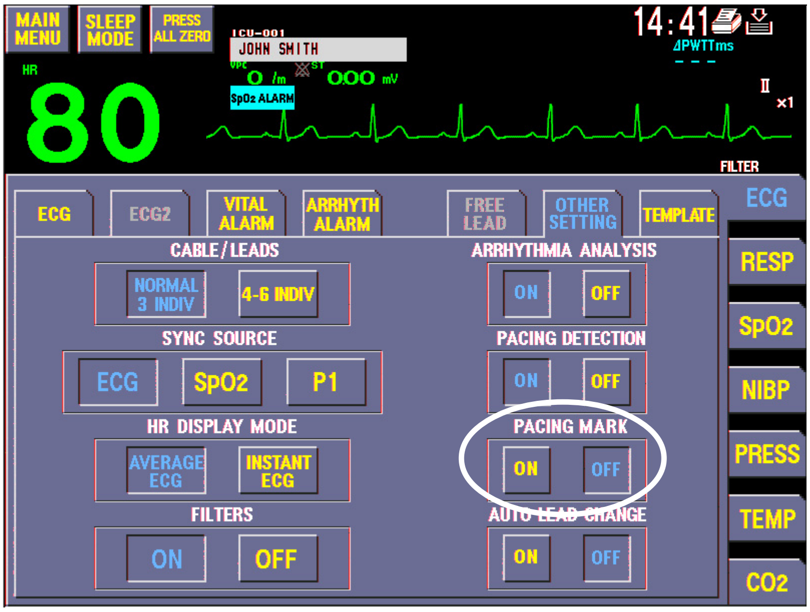


1. Press the MENU key on the front panel to display the MENU window.

2. Touch the "ECG" key. The ECG VITAL ALARM window appears.


MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
HR
80
VPC 0 /m
ST 0.00 mV
SpO2 ALARM
14:40
ΔPWTTms
II
×1
FILTER
ECG
ECG2
VITAL ALARM
ARRHYTH ALARM
FREE LEAD
OTHER SETTING
TEMPLATE
SENSITIVITY
×1/4
×1/2
AUTO
×1
×2
×4
HR/PR
80
95
40
300
200
100
0
ST
mV
0.00
OFF
OFF
+2.0
0.0
-2.0
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2

3. Touch the "OTHER SETTING" tab to display the OTHER SETTING window.


MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
HR
80
VPC 0 /m
ST 0.00 mV
SpO2 ALARM
14:41
ΔPWTTms
II
×1
FILTER
ECG
ECG2
VITAL ALARM
ARRHYTH ALARM
FREE LEAD
OTHER SETTING
TEMPLATE
CABLE/LEADS
NORMAL 3 INDIV
4-6 INDIV
SYNC SOURCE
ECG
SpO2
P1
HR DISPLAY MODE
AVERAGE ECG
INSTANT ECG
FILTERS
ON
OFF
ARRHYTHMIA ANALYSIS
ON
OFF
PACING DETECTION
ON
OFF
PACING MARK
ON
OFF
AUTO LEAD CHANGE
ON
OFF
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2

4. Touch the "ON" or "OFF" key in the PACING MARK box to select on or off.

5. Press the HOME key on the front panel to return to the monitoring screen.

Use with an Electrosurgical Unit

For use with an electrosurgical unit (ESU), this monitor has a circuit to protect the patient from skin burn and to reduce ESU interference on the ECG waveform. However, the effectiveness of this circuit depends on electrode position and monitor setup. With an ESU, pay attention to the following points.

WARNING

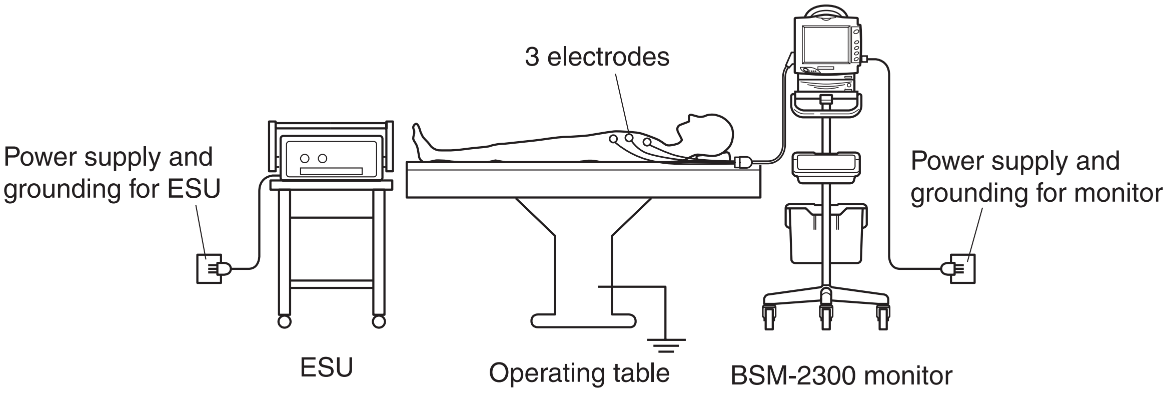
When using this monitor with an ESU, the ESU return plate and the electrodes for monitoring must be firmly attached to the patient. If the return plate is not attached correctly, it may burn the patient's skin where the electrodes are attached. Refer to the instruction manual for the ESU.

CAUTION

Install the monitor and ESU appropriately and perform equipotential grounding. Otherwise, noise from the ESU may interfere with the ECG and ECG monitoring may not be performed properly.

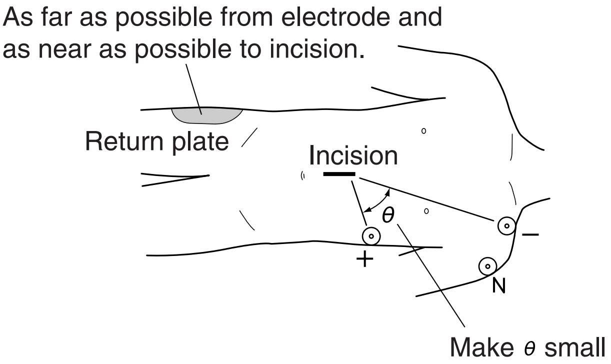
- Arrangement
  Install the monitor as far from the ESU as possible. If possible, locate them on opposite sides of the operating table.

- Power Supply
  Noise from the ESU may interfere with the ECG signal through the AC power line. Supply power to the monitor and ESU from different outlets located as far from each other as possible. Do the equipotential grounding properly.


3 electrodes
Power supply and grounding for ESU
Power supply and grounding for monitor
ESU
Operating table
BSM-2300 monitor

- Measure with 3-electrode Lead
  Use the minimum number of electrodes. Use new electrodes.

- Minimizing Noise
  1. Select an ECG lead where the active ECG electrodes are located as far from the incision as possible.
  2. Position the + and – electrodes as close as possible.
  3. Select the leads where the angle (θ) between the active electrodes and the incision is as small as possible.
  4. Set the electrosurgical return plate as close to the incision as possible.


As far as possible from electrode and as near as possible to incision.
Return plate
Incision
θ
+
–
N
Make θ small

- Set the following items on the OTHER SETTING window of the ECG window.
  FILTERS: ON
  SYNC SOURCE: SpO_2 or P1
  (When the heart rate is unstable because of an ESU, select SpO_2 or P1.)

- Monitor respiration by thermistor method or monitor CO_2
  Noise is superimposed on the waveform and the respiration rate cannot be monitored accurately in the impedance method. When monitoring respiration, turn respiration monitoring off or monitor the respiration by thermistor method or monitor CO_2.

Section 11 Respiration Monitoring

General 11.1
    Measurement Method 11.1
        Impedance Method 11.1
        Thermistor Method 11.2
Preparing for Respiration Monitoring in Impedance Method 11.3
    Preparation Flowchart 11.3
    Electrode Position and Waveform Examples 11.4
    Connecting Cables and Attaching Disposable Electrodes 11.6
Preparing for Respiration Monitoring in Thermistor Method 11.7
    Preparation Flowchart 11.7
    Respiration Pickups 11.7
    Connecting the Cable to the Monitor 11.8
    Attaching the Respiration Pickup 11.8
        When Using Respiration Pickup for Airway 11.8
        When Using Respiration Pickup for Nose 11.9
Monitoring Respiration 11.10
    Respiration Information on the Monitoring Screen 11.10
Changing Respiration Settings 11.12
    Turning Respiration Monitoring On or Off in Impedance Method 11.12
    Changing the Monitoring Lead in Impedance Method 11.14
    Changing the Respiration Sensitivity 11.15
    Changing the Respiration Waveform Sweep Speed 11.16
    Changing the Apnea Alarm Limit 11.17
    Changing the Respiration Alarm Limits 11.18

General

On this monitor, respiration can be measured by two methods: impedance method and thermistor method. When respiration is measured by both the impedance method and thermistor method, the values measured by the thermistor method are used.

WARNING

Interaction Between Minute Ventilation Rate-Adaptive Pacemakers and Cardiac Monitoring and Diagnostic Equipment*
The bioelectric impedance measurement sensor of a minute ventilation rate-adaptive implantable pacemaker may be affected by cardiac monitoring and diagnostic equipment which is connected to the same patient. If this occurs, the pacemaker may pace at its maximum rate and give incorrect data to the monitor or diagnostic equipment. If this occurs, disconnect the monitor or diagnostic equipment from the patient or change the setting on the pacemaker by referring to the pacemaker's manual. For more details, contact your pacemaker distributor or Nihon Kohden distributor.

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* Minute ventilation is sensed in rate-adaptive pacemakers by a technology known as bioelectric impedance measurement (BIM). Many medical devices in addition to pacemakers use this technology. When one of these devices is used on a patient with an active, minute ventilation rate-adaptive pacemaker, the pacemaker may erroneously interpret the mixture of BIM signals created in the patient, resulting in an elevated pacing rate.

For more information, see the FDA web site.
http://www.fda.gov/cdrh/safety.html

Measurement Method

Impedance Method

In the impedance method, respiration is measured and monitored by attaching the ECG electrodes to the patient and connecting them to the ECG/RESP socket on the monitor. This method measures changes in impedance between the R and F (RA and LL) or R and L (RA and LA) ECG electrodes.

When the ESU is used in impedance method, noise is superimposed on the waveform and respiration rate cannot be monitored accurately. In such a case, turn the respiration monitoring off or monitor respiration by thermistor method.

Thermistor Method

In the thermistor method, respiration is measured and monitored by attaching the respiration pickup to the patient or connecting it to the respiration circuit, and connecting it to a multi-parameter socket on the monitor.

This method measures and compares temperature changes caused by respiration and inspiration using the respiration pickup.

Use this method when using the ESU or if measurement by the impedance method is unavailable.

Preparing for Respiration Monitoring in Impedance Method

Preparation Flowchart

The procedure is the same as for monitoring ECG.

1. Select the electrode lead.

2. Connect the electrode lead to the ECG connection cord and ECG connection cord to the ECG/RESP socket on the monitor.

3. Attach the disposable electrodes to the patient and attach the electrode lead to the electrodes. Attach R and F (RA and LL) or R and L (RA and LA) with the lungs between the electrodes.

4. Monitoring starts. Set necessary settings.

   For handling accessories after use, refer to Section 18.

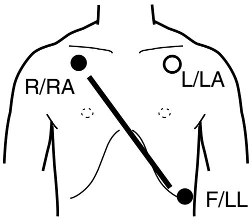
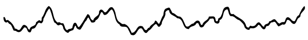
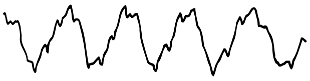
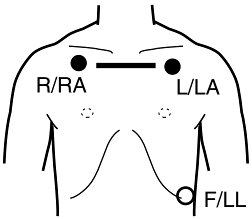
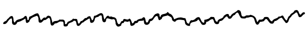
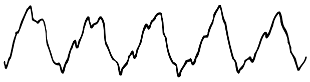
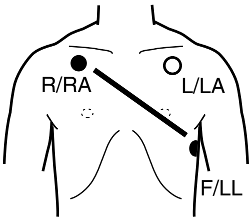
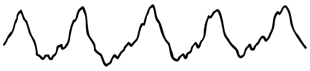
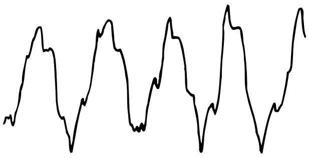
Electrode Position and Waveform Examples

Respiration can be measured by the impedance method when the R (RA) and F (LL) or R (RA) and L (LA) electrodes are placed so that the lungs are between the electrodes.

The optimum electrode positions for ECG monitoring of a patient are not always optimum for respiration monitoring of the patient.

Select the optimum positions for both ECG and respiration measurements or measure respiration by the thermistor method.

The amplitude of the respiration waveform differs according to the electrode positions. The following shows different examples of respiration waveforms according to the electrode position when monitoring with the impedance method.

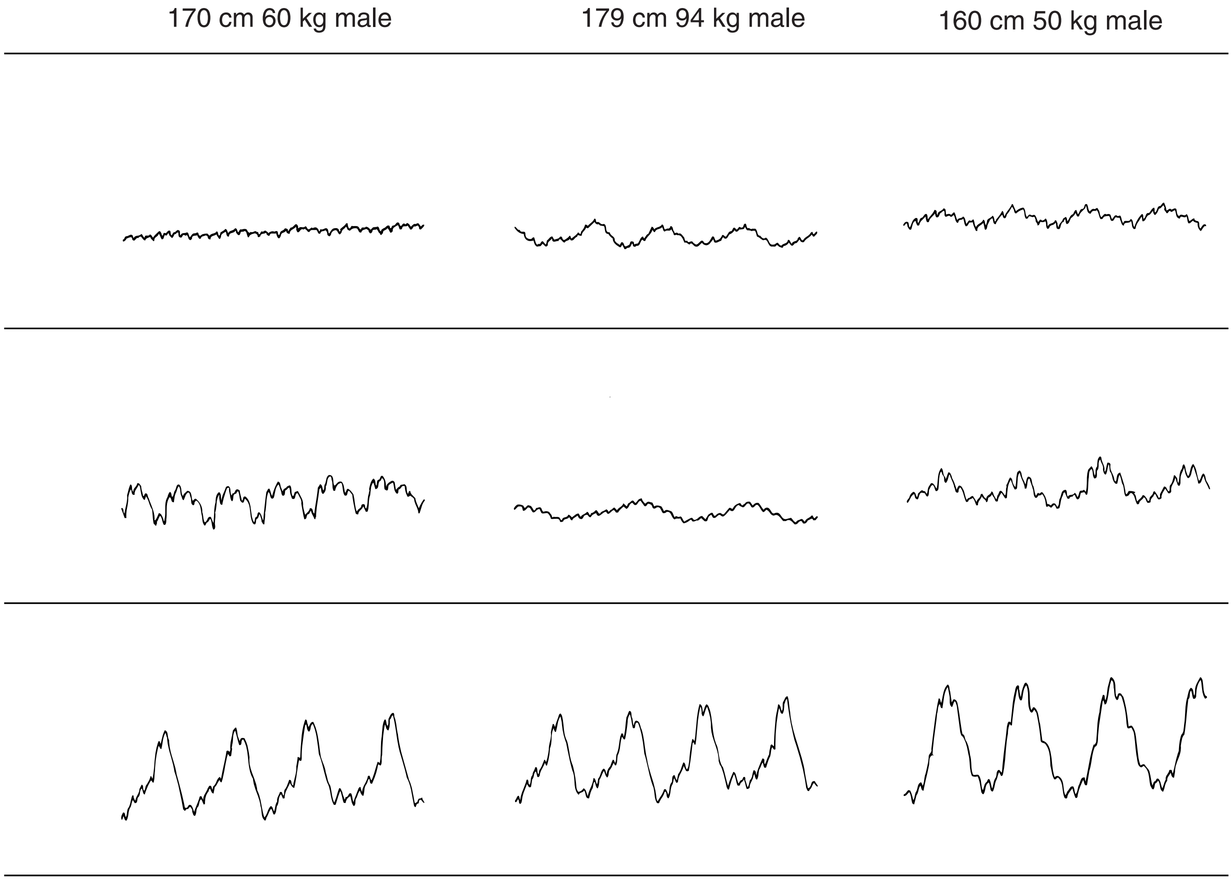
	Electrode lead and position	162 cm 47 kg female	153 cm 45 kg female
①	 Standard R-F/RA-LL		
②	 R-L/RA-LA		
③	 R-F/RA-LL with higher F/LL position		

Electrode Position

	R or RA	F or LL	L or LA
①	Right infraclavicular fossa	Lowest rib on the left anterior axillary line	—
②	Right infraclavicular fossa	—	Left infraclavicular fossa
③	Right infraclavicular fossa	Fifth intercostal space on the left midaxillary line	—

Amplitude

①	Respiration measurement is influenced by movement of the chest and abdomen. The amplitude of the waveform changes greatly according to slight change of the F (LL) electrode position. It also differs considerably between different patients.
②	Respiration measurement is influenced by movement of the chest. Detects thoracic respiration. There is a great difference in amplitude between different patients.
③	Respiration amplitude is large, and therefore, detection rate is good. The electrode position is similar to lead II of the ECG. This position is highly recommended.



Connecting Cables and Attaching Disposable Electrodes

Connecting cables and attaching disposable electrodes are the same as for the ECG monitoring. Refer to “Preparing for ECG Monitoring” in Section 10.

Preparing for Respiration Monitoring in Thermistor Method

Preparation Flowchart

1. Select the respiration pickup.

2. Connect the respiration pickup to a multi-parameter socket on the monitor.

NOTE

On BSM-2304, respiration cannot be monitored when connected to the PRESS1 socket.

3. Attach the respiration pickup to the respiration circuit.

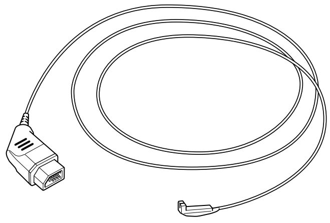
4. Monitoring starts. Set necessary settings.

   For handling accessories after use, refer to Section 18.

Respiration Pickups

Respiration pickup for nose TR-900P*

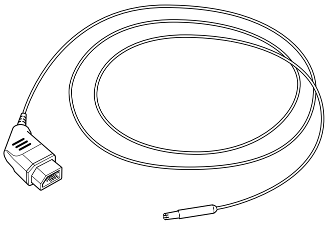
For measuring at nostrils.



* This part has not been checked for compliance with the MDD (Medical Device Directive). For EC member countries, Nihon Kohden recommends the use of parts that comply with MDD.

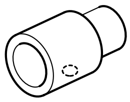
Respiration pickup for airway TR-910P

For measuring with trachea intubation.



Airway adapter YG-001P

Use with the TR-910P respiration pickup.



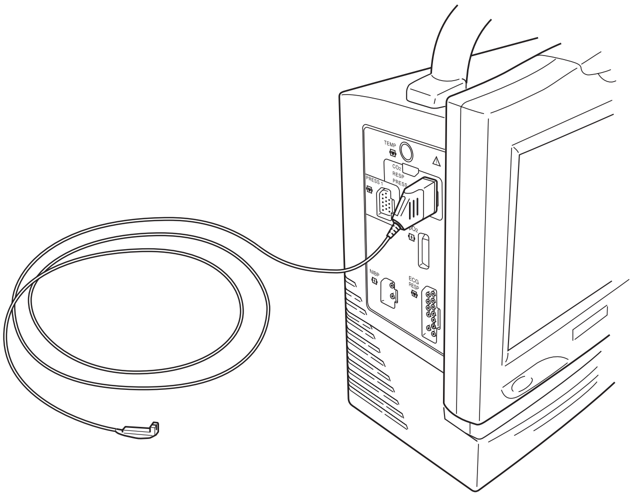
Connecting the Cable to the Monitor

Connect the respiration pickup to a multi-parameter socket on the monitor.

NOTE

On BSM-2304, respiration cannot be monitored when connected to the PRESS1 socket.

When connecting the respiration pickup for nose

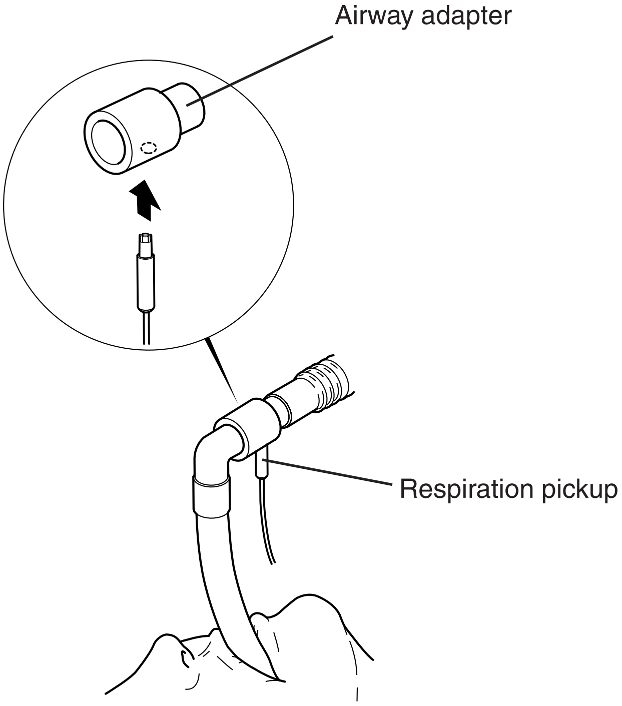

TEMP
CO_2
RESP
PRESS
PRESS 1
pO2
NIBP
ECG
RESP

Attaching the Respiration Pickup

When Using Respiration Pickup for Airway

1. Firmly insert the tip of the respiration pickup for airway into the small hole on the airway adapter.

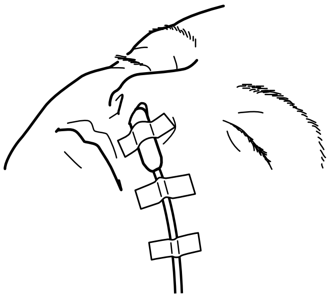
2. Connect the airway adapter to the airway tube (between the mouth and Y-shaped tube).


Airway adapter
Respiration pickup

When Using Respiration Pickup for Nose

1. Place the tip of the respiration pickup at the front of the nostril.

2. Secure the lead wire and respiration pickup firmly to the cheek with surgical tape.



Monitoring Respiration

When preparation is done properly, the respiration waveform appears on the screen.

NOTE

Increase in the temperature of the inspired air during monitoring in thermistor method causes decrease in the temperature difference between inspiration and expiration, and the amplitude of the respiration waveform becomes small. When the inspiration temperature increases higher than the expiration temperature, the phases of expiration and inspiration may be reversed.

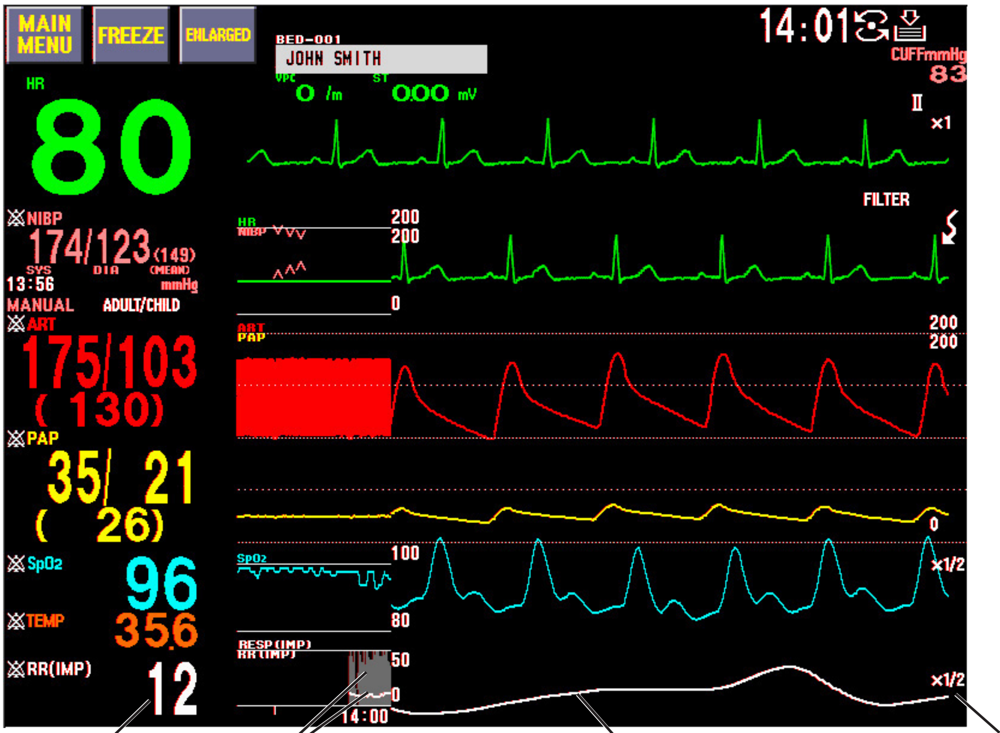
In impedance method, the respiration data do not appear on the screen when IMP RESP MEASURE is set to OFF. When using an ESU, noise is superimposed on the waveform and the respiration measurement cannot be monitored accurately. When respiration monitoring is necessary, use the thermistor method or monitor CO_2.

The respiration waveform sweep speed can be set to either 1.56 or 25 mm/s on the OTHER SETTINGS window of the RESP window.

For error messages and monitoring problems, refer to Section 17.

Respiration Information on the Monitoring Screen

In impedance method


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
14:01
CUFFmmHg
83
VPC 0 /m
ST 0.00 mV
II
×1
HR
80
FILTER
NIBP
174/123 (149)
SYS DIA (MEAN)
13:56
mmHg
MANUAL
ADULT/CHILD
HR
NIBP
200
200
0
ART
175/103
(130)
ART
PAP
200
200
PAP
35/ 21
(26)
0
SpO2
96
SpO2
100
80
×1/2
TEMP
35.6
RR(IMP)
12
RESP(IMP)
RR(IMP)
50
0
14:00
×1/2

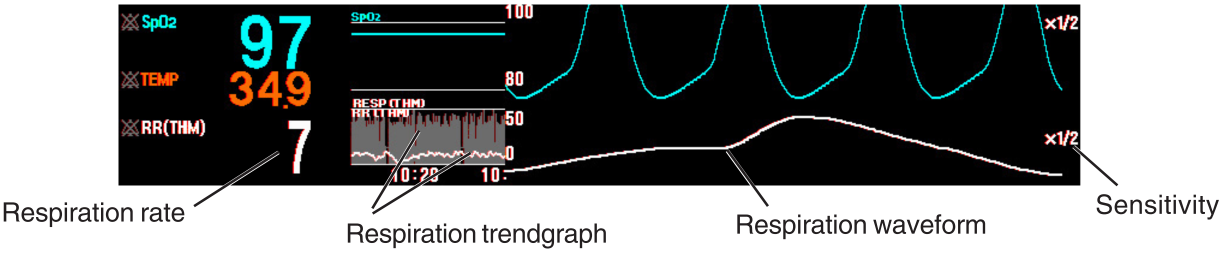
Respiration rate

Respiration trendgraph

Respiration waveform

Sensitivity

In thermistor method


SpO2
97
TEMP
34.9
RR(THM)
7
SpO2
100
80
RESP (THM)
RR (THM)
50
0
10:20
10:
×1/2
×1/2
Respiration rate
Respiration trendgraph
Respiration waveform
Sensitivity

Changing Respiration Settings

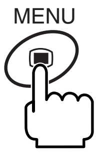
Change settings on the RESP window. The following settings can be changed for respiration monitoring.

- Turning respiration monitoring on or off in impedance method
- Changing monitoring lead in impedance method
- Respiration waveform sweep speed
- Respiration sensitivity
- Apnea alarm limits
- Respiration rate alarm setting

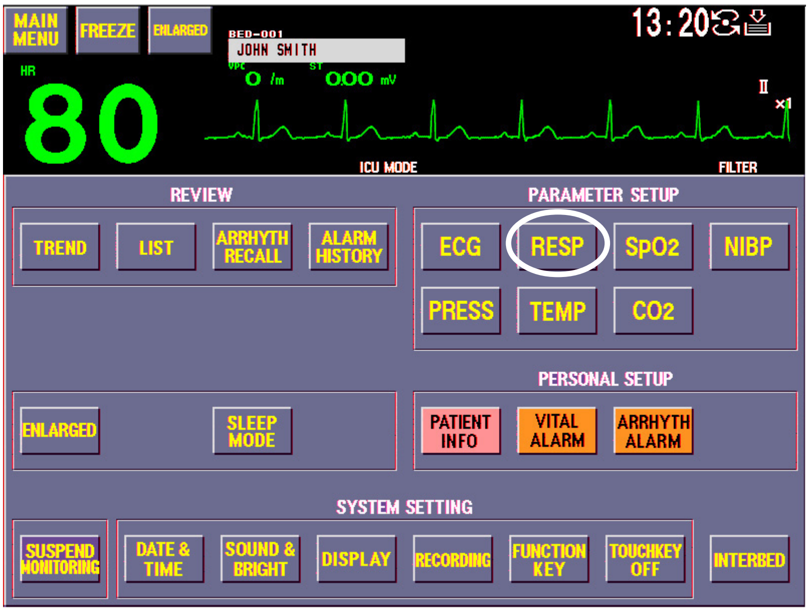
Turning Respiration Monitoring On or Off in Impedance Method

You can turn respiration monitoring off if you do not need it. When respiration is turned off, the respiration waveform does not appear and the “RESP OFF” message appears on the monitoring screen.

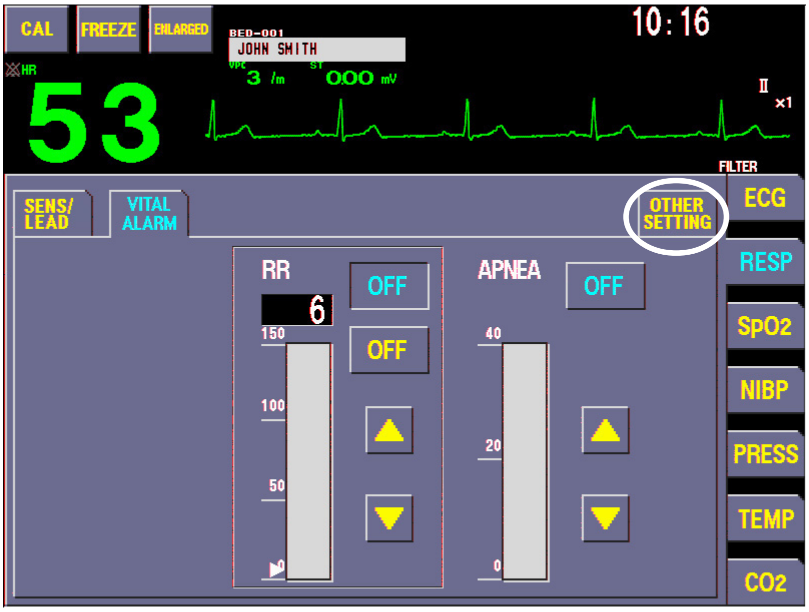
When using an ESU, noise is superimposed on the waveform and the respiration measurement cannot be monitored accurately. Set the respiration measurement to OFF or when respiration monitoring is necessary, use thermistor method or monitor CO_2.



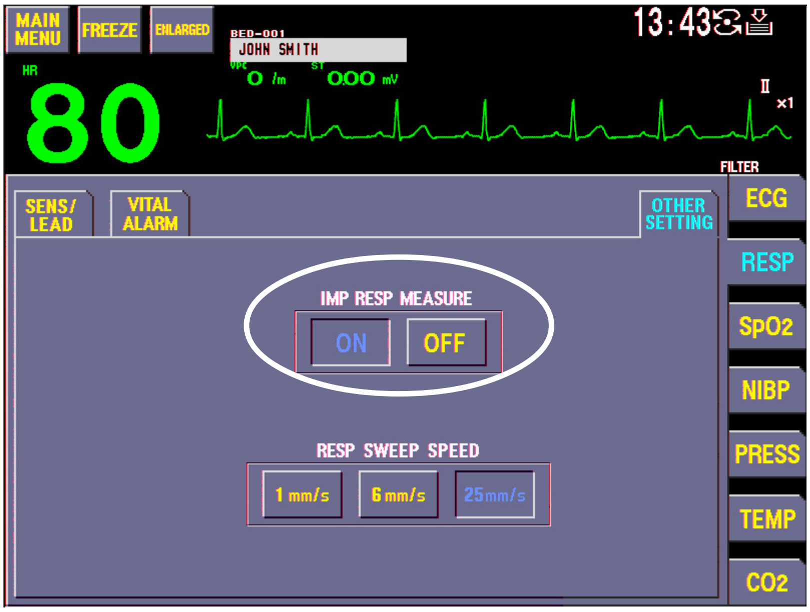
1. Press the MENU key on the front panel to display the MENU window.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC
0 /m
ST
0.00 mV
II
×1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

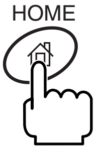
2. Touch the “RESP” key. The RESP VITAL ALARM window appears.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
10:16
HR
53
VPC 3 /m
ST 0.00 mV
II
×1
FILTER
SENS/ LEAD
VITAL ALARM
OTHER SETTING
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
RR
6
OFF
OFF
150
100
50
0
APNEA
OFF
40
20
0

3. Touch the “OTHER SETTING” tab on the RESP window.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:43
HR
80
VPC 0 /m
ST 0.00 mV
II
×1
FILTER
SENS/ LEAD
VITAL ALARM
OTHER SETTING
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
IMP RESP MEASURE
ON
OFF
RESP SWEEP SPEED
1 mm/s
6 mm/s
25mm/s

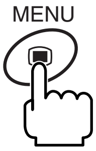
4. Touch the “ON” or “OFF” key in the IMP RESP MEASURE box to set on or off.



5. Press the HOME key on the front panel to return to the monitoring screen.

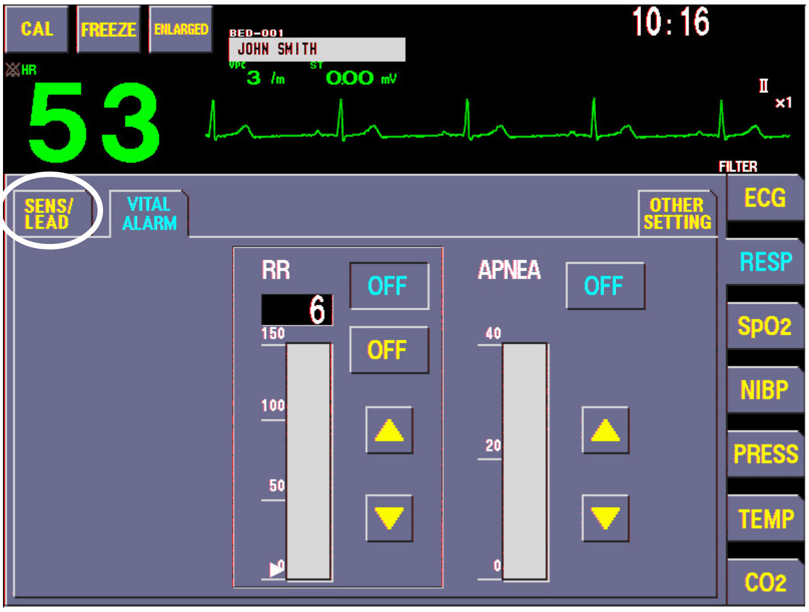
Changing the Monitoring Lead in Impedance Method

The lead which can be monitored in the impedance method is R-F (RA-LL) or R-L (RA-LA). The selected lead appears on both the monitoring screen and RESP window.

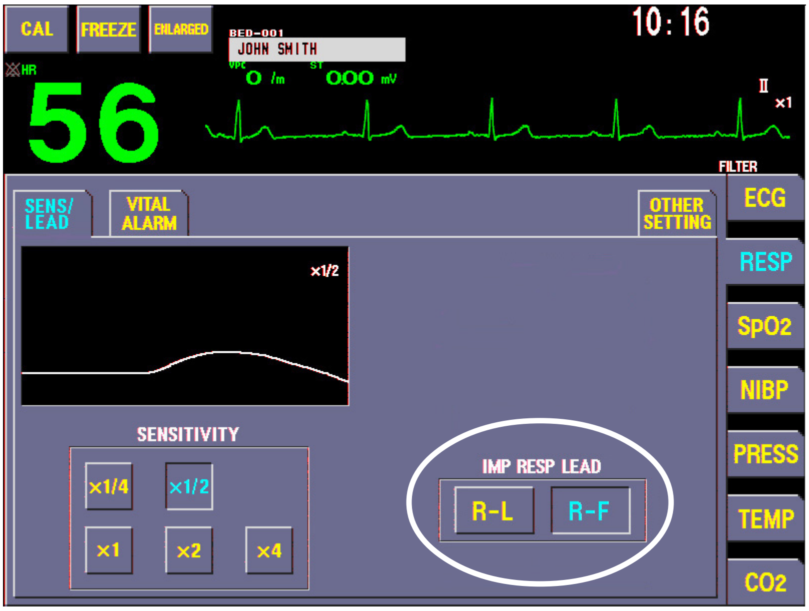


1. Press the MENU key on the front panel to display the MENU window.

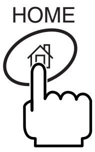
2. Touch the “RESP” key. The RESP VITAL ALARM window appears.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
10:16
HR
53
VPC 3 /m
ST 0.00 mV
II ×1
FILTER
SENS/ LEAD
VITAL ALARM
OTHER SETTING
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
RR
6
OFF
OFF
150
100
50
0
APNEA
OFF
40
20
0

3. Touch the “SENS/LEAD” tab on the RESP window.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
10:16
HR
56
VPC 0 /m
ST 0.00 mV
II ×1
FILTER
SENS/ LEAD
VITAL ALARM
OTHER SETTING
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
×1/2
SENSITIVITY
×1/4
×1/2
×1
×2
×4
IMP RESP LEAD
R-L
R-F

4. Select the lead from the IMP RESP LEAD box.

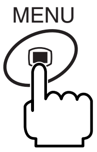


5. Press the HOME key on the front panel to return to the monitoring screen.

Changing the Respiration Sensitivity

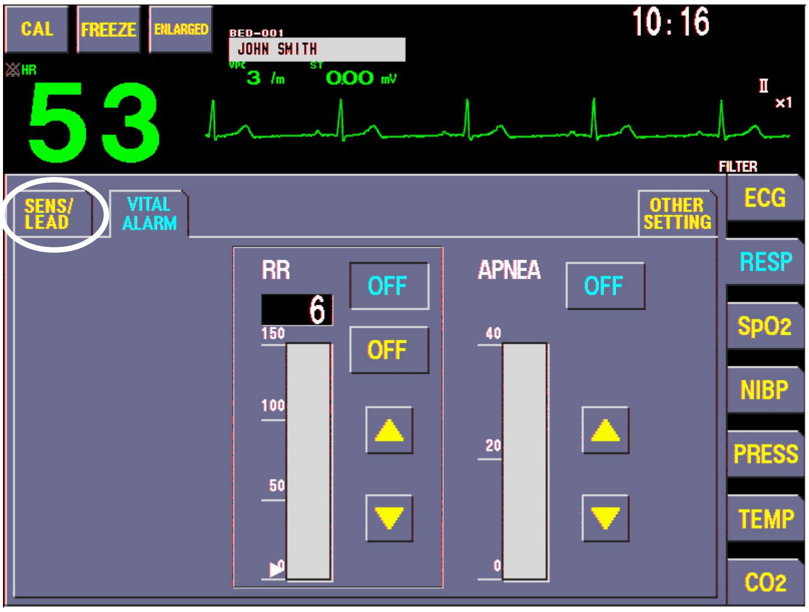
The sensitivity determines the size of the waveform on both the screen and recording paper.

When NOISE REDUCTION ON IMPEDANCE RESP is set to OFF on the SYSTEM SETUP screen, the respiration waveform amplitudes larger than 10 mm are counted for the respiration rate.

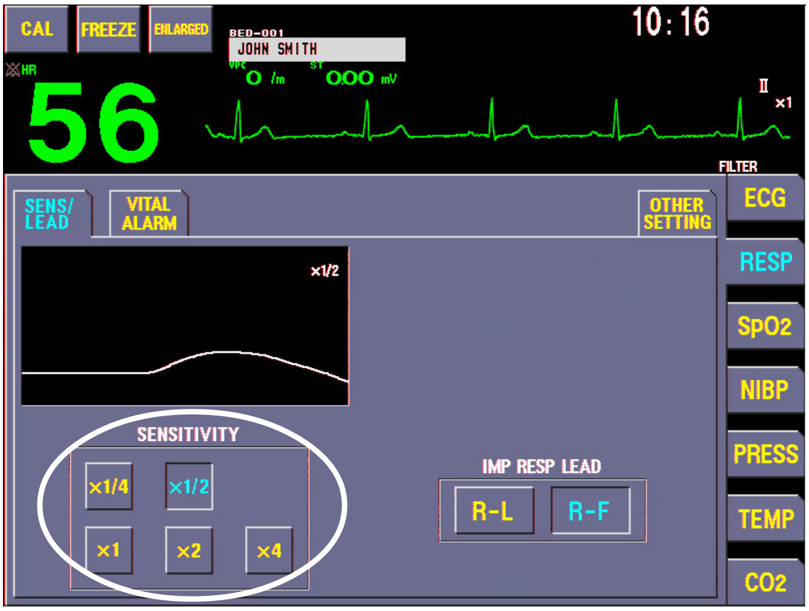


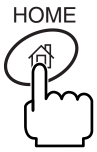
1. Press the MENU key on the front panel to display the MENU window.

2. Touch the “RESP” key. The RESP VITAL ALARM window appears.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
10:16
HR
53
VPC 3 /m
ST 0.00 mV
II
×1
FILTER
SENS/ LEAD
VITAL ALARM
OTHER SETTING
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
RR
6
OFF
OFF
150
100
50
0
APNEA
OFF
40
20
0

3. Touch the “SENS/LEAD” tab on the RESP window.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
10:16
HR
56
VPC 0 /m
ST 0.00 mV
II
×1
FILTER
SENS/ LEAD
VITAL ALARM
OTHER SETTING
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
×1/2
SENSITIVITY
×1/4
×1/2
×1
×2
×4
IMP RESP LEAD
R-L
R-F

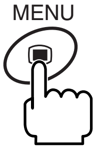


4. Select the sensitivity by touching the desired sensitivity in the SENSITIVITY box.

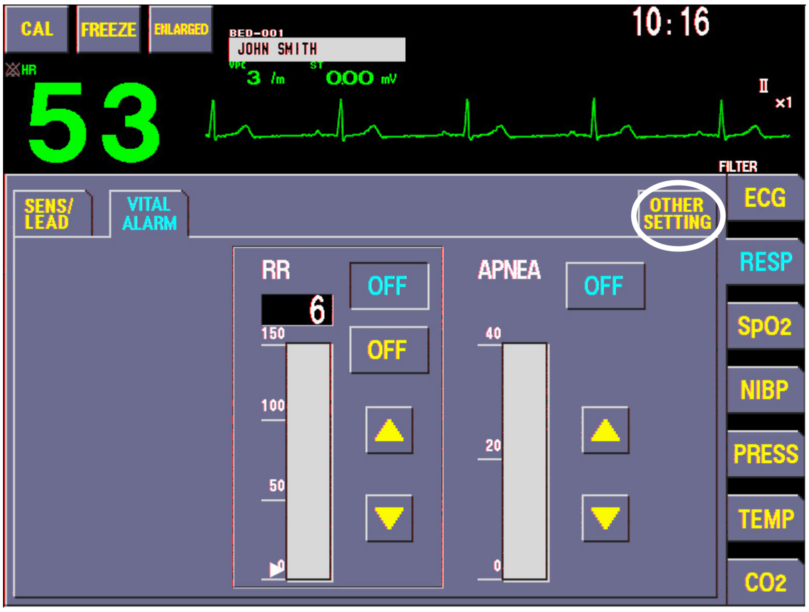
5. Press the HOME key on the front panel to return to the monitoring screen.

Changing the Respiration Waveform Sweep Speed

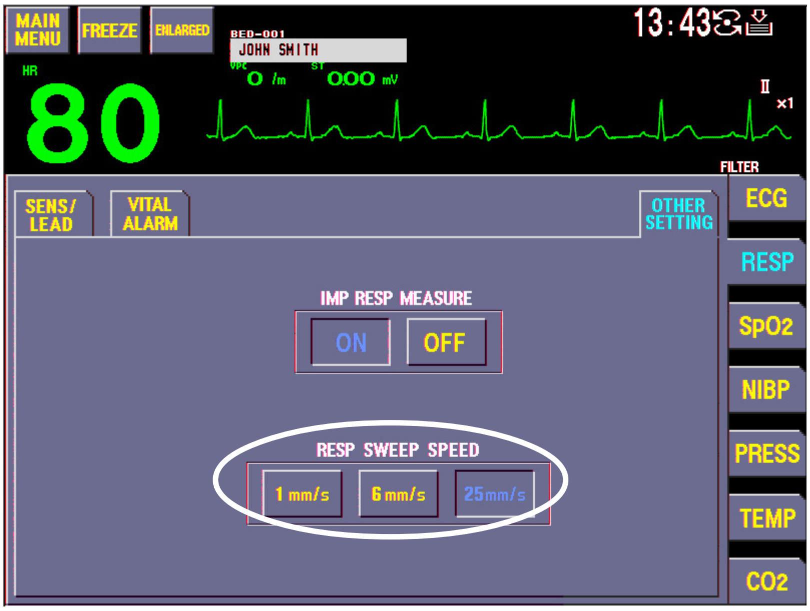
The respiration waveform sweep speed on the screen can be selected from 1, 6, or 25 or 50 mm/s.



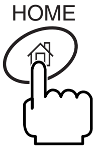
1. Press the MENU key on the front panel to display the MENU window.
2. Touch the “RESP” key. The RESP VITAL ALARM window appears.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
10:16
HR
53
VPC 3 /m
ST 0.00 mV
II ×1
FILTER
SENS/LEAD
VITAL ALARM
OTHER SETTING
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
RR
6
OFF
OFF
150
100
50
0
APNEA
OFF
40
20
0

3. Touch the “OTHER SETTINGS” tab on the RESP window.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:43
HR
80
VPC 0 /m
ST 0.00 mV
II ×1
FILTER
SENS/LEAD
VITAL ALARM
OTHER SETTING
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
IMP RESP MEASURE
ON
OFF
RESP SWEEP SPEED
1 mm/s
6 mm/s
25mm/s

4. Select the respiration waveform sweep speed on the screen from the RESP SWEEP SPEED box.



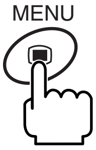
5. Press the HOME key on the front panel to return to the monitoring screen.

Changing the Apnea Alarm Limit

CAUTION

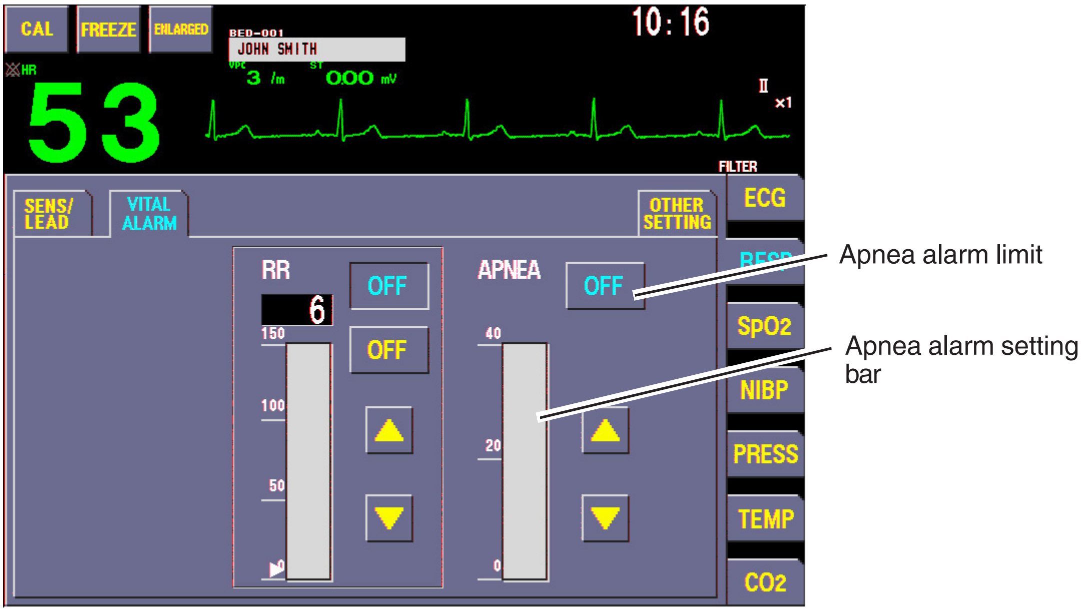
When the alarm limit is turned off, there will be no apnea alarm.

You can set the apnea alarm limit on the RESP window. You can set all alarms, including the apnea alarm limit, on the VITAL ALARM window (See Section 6).

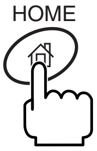


1. Press the MENU key on the front panel to display the MENU window.

2. Touch the “RESP” key. The RESP VITAL ALARM window appears.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
10:16
HR
53
VPC 3 /m
ST 0.00 mV
II ×1
FILTER
SENS/ LEAD
VITAL ALARM
OTHER SETTING
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
RR
OFF
6
OFF
150
100
50
0
APNEA
OFF
40
20
0
Apnea alarm limit
Apnea alarm setting bar

3. Touch the desired level on the setting bar. Touch the ▲ or ▼ key to adjust the setting.



4. Press the HOME key on the front panel to return to the monitoring screen.

Changing the Respiration Alarm Limits

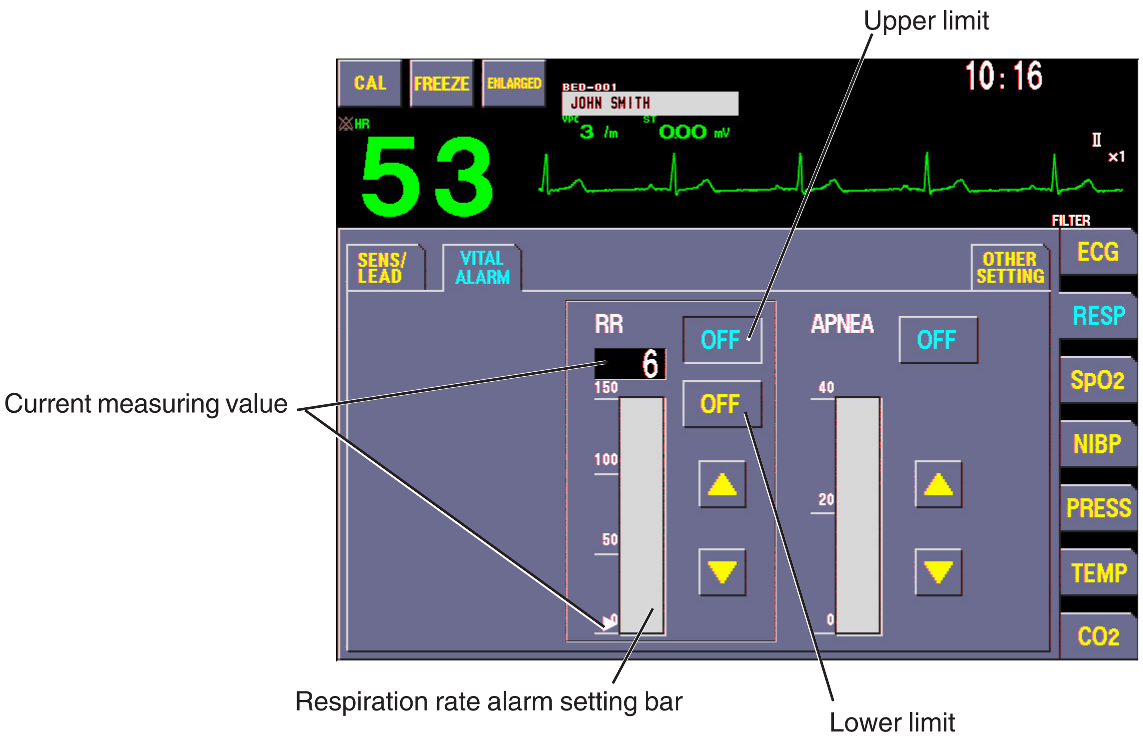
CAUTION

When the upper or lower alarm limit is turned off, there will be no respiration rate upper or lower alarm for that limit.

You can set the upper and lower respiration rate alarm limits on this window. Other alarm items must be set on the VITAL ALARM window. You can set all alarms, including the upper and lower respiration rate alarm limits, on the VITAL ALARM window (See Section 6).

MENU

1. Press the MENU key on the front panel to display the MENU window.
2. Touch the “RESP” key. The RESP VITAL ALARM window appears.


Upper limit
CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
10:16
HR
53
VPC 3 /m
ST 0.00 mV
II ×1
FILTER
SENS/ LEAD
VITAL ALARM
OTHER SETTING
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
RR
OFF
6
150
100
50
0
OFF
APNEA
OFF
40
20
0
Current measuring value
Respiration rate alarm setting bar
Lower limit

3. Touch the upper limit box to set the upper limit or touch the lower limit box to set the lower limit.
4. Touch the desired level on the setting bar. Touch the ▲ or ▼ key to adjust the setting.

   If the upper limit is set to a value above the maximum or the lower limit is set to a value below the minimum, the alarm is set to OFF.

HOME

5. Press the HOME key on the front panel to return to the monitoring screen.

Section 12 SpO_2 Monitoring

General 12.1
Preparing for SpO_2 Monitoring 12.2
    Preparation Flowchart 12.2
    Selecting a Probe 12.3
        Nihon Kohden Reusable Probes 12.3
        Nihon Kohden Disposable Probes 12.4
        Nellcor SpO_2 Probes 12.5
    Connecting Cables 12.6
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    Attaching the Probe to the Patient 12.7
Monitoring SpO_2 .... 12.9
    SpO_2 Information on the Monitoring Screen 12.10
    Detection and Display of Measurement Condition 12.11
        CHECK PROBE Message (When the Finger Probe is Used) 12.11
        DETECTING PULSE Message 12.11
        M Message 12.11
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    Changing the Pulse Waveform Sensitivity 12.12
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    Changing the Sync Source 12.15
    Selecting Sync Sound Pitch 12.16
    Selecting the Response Mode 12.18

General

SpO_2 is monitored by attaching a probe to the patient and using the SpO_2 socket on the monitor.

WARNING

- **Measurement may be incorrect in the following cases.**
  - **When the patient's carboxyhemoglobin or methemoglobin increases abnormally.**
  - **When dye is injected in the blood.**
  - **When using an electrical surgery unit.**
  - **During CPR.**
  - **When there is body movement.**
  - **When there is vibration.**
  - **When measuring at a site with venous pulse.**
  - **When the pulse wave is small (insufficient peripheral circulation).**
  - **When using an IABP (intra-aortic balloon pump).**
- **Check the circulation condition by observing the skin color of the measuring site and pulse waveform. Change the measuring site every 8 hours for disposable probes and every 4 hours for reusable probes. The skin temperature may increase at the attached site by 2 or 3°C (4 or 5°F) and cause a burn or pressure necrosis. When using the probe on the following patients, take extreme care and change the measurement site more frequently according to symptoms and degree.**
  - **A patient with a fever**
  - **A patient with peripheral circulation insufficiency**
  - **Neonate or low birth weight infant with delicate skin**
- **When using the TL-201T finger probe, do not fasten the probe and cable to the finger by wrapping with tape. This may cause burn, congestion or pressure necrosis from poor blood circulation.**
- **When using probes other than the TL-201T finger probe, to avoid poor circulation, do not wrap the tape too tight. Check the blood circulation condition by observing the skin color and congestion at the skin peripheral to the probe attachment site. Even for short-term monitoring, there may be burn or pressure necrosis from poor blood circulation, especially on neonates or low birth weight infants whose skin is delicate. Accurate measurement cannot be performed on a site with poor peripheral circulation.**
- **When not monitoring SpO_2, disconnect the SpO_2 connection cord from the monitor. Otherwise, noise may interfere from the probe sensor and incorrect data is displayed on the screen.**

CAUTION

- **Turn off the power of cell telephones, small wireless devices and other**

devices which produce strong electromagnetic interference. Otherwise, the waveforms and measurements are affected by such interference and the displayed data may be incorrect.

- **Normally external light does not affect monitoring, however, strong light such as an operating lamp or sunlight may affect monitoring. If affected, cover the measuring site with a blanket.**
- **Do not pull or bend the probe cable, and do not put caster feet on the probe cable. Do not immerse the probe cable in detergents or water. Failure to follow these cautions may cause cable discontinuity, short circuit, skin burn on the patient and incorrect measurement data. Replace any broken probe with a new one.**
- **While a patient is on medication which causes vasodilation, the pulse waveform may change and in rare cases the SpO_2 value may not be displayed.**

NOTICE

Purchase of this instrument confers no express or implied license under any Nellcor Puritan Bennett patent to use this instrument with any oximetry sensor that is not manufactured or licensed by Nellcor Puritan Bennett.

The above notice only applies to the BSM-2304 monitor.

Preparing for SpO_2 Monitoring

Preparation Flowchart

1. Select the probe.

2. Connect the probe to the SpO_2 connection cord and SpO_2 connection cord to the SpO_2 socket on the monitor.

3. Attach the probe to the patient.

4. Monitoring starts. Set necessary settings.
   For handling accessories after use, refer to Section 18.

Selecting a Probe

Select the appropriate probe according to the purpose. Use Nihon Kohden probes on the BSM-2301/2351 monitor and Nellcor probes on the BSM-2304 monitor.

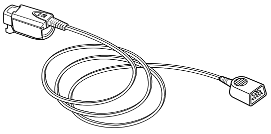
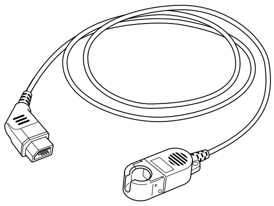
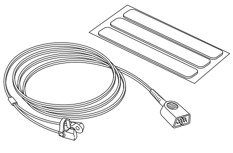
WARNING

Do not use the probe during MRI examination because it may cause skin burn on the probe attachment area. For details, follow the MRI operator's manual.

CAUTION

- **Only use the specified probe. Otherwise measured data may be incorrect.**
- **Do not use a damaged or disassembled probe. It causes incorrect measurement and may hurt the patient.**
- **Do not use the probe over its stated lifetime. Otherwise the SpO_2 measurement accuracy cannot be guaranteed.**

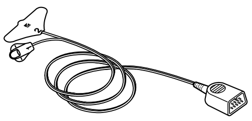
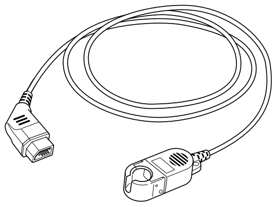
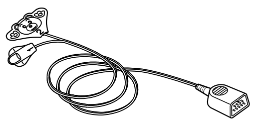
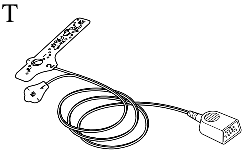
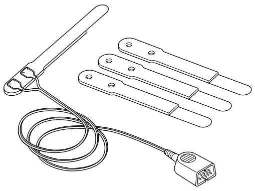
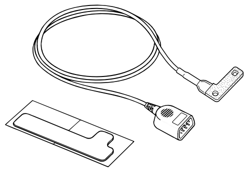
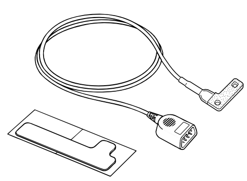
Nihon Kohden Reusable Probes

Model	Subject (Weight)	Attachment Site	SpO2 Connection Cord
Finger Probe TL-201T 	Adults, children (Weight more than 20 kg)	Finger	JL-900P 
Multi-site Probe TL-220T 	Adults, infants (Weight 3 kg or more)	Finger or toe	
	Neonates (Weight 3 kg or less)	Instep and sole	

Nihon Kohden Disposable Probes

CAUTION

- **Do not reuse the disposable probes for another patient because it causes cross infection.**
- **Disposable probes are not sterilized. To sterilize the probe, refer to the probe's manual.**

Model	Subject (Weight)	Attachment Site	SpO_2 Connection Cord
TL-251T 	Adults (Weight more than 30 kg)	Finger or toe	JL-900P 
TL-252T 	Children (Weight from 3 to 40 kg)	Finger or toe	
TL-253T 	Neonates (Weight less than 3 kg)	Instep and sole	
TL-260T 	Adults, children (Weight more than 3 kg)	Finger or toe	
	Neonates (Weight less than 3 kg)	Instep and sole	
TL-051S/052S  Cable length TL-051S: 80 cm TL-052S: 160 cm	Adults (Weight more than 50 kg)	Finger	
	Neonates (Weight less than 3 kg)	Instep and sole	
TL-061S/062S  Cable length TL-061S: 80 cm TL-062S: 160 cm	Adults, children (Weight from 15 to 50 kg)	Finger	
	Children, infants (Weight from 3 to 15 kg)	Toe	

Nellcor SpO_2 Probes

For Nellcor probes, use OxiMAX™ series sensor probes. To use Nellcor probes, the OEM-10 connection cord is required.

The Nellcor probes and cables are available direct from Nellcor Puritan Bennett or their suppliers.

CAUTION

- **Do not reuse adhesive probes for other patients.**
- **Only use the OEM-10 connection cord on this monitor.**
- **Only use the OxiMAX™ series sensor probes on this monitor.**

The following Nellcor probes can be used with this bedside monitor.

OxiMax Adhesive Sensors: Single-page use

Description	Weight Range	Qty	Catalog #
MAX-FAST Adhesive Forehead Sensor	>40 kg	Case of 24	MAXFAST
MAX-FAST Headband	—	Case of 12	064592
MAX-A Adhesive Sensor, adult	>30 kg	Case of 24	MAXA
MAX-AL Adhesive Sensor, adult (longer, 36 inch cable)	>30 kg	Case of 24	MAXAL
MAX-N Adhesive Sensor, neonatal/adult	<3 kg or >40 kg	Case of 24	MAXN
MAX-P Adhesive Sensor, pediatric	10 to 50 kg	Case of 24	MAXP
MAX-I Adhesive Sensor, infant	3 to 20 kg	Case of 24	MAXI
MAX-R Adhesive Sensor, adult nasal	>50 kg	Case of 24	MAXR
MAX Sensor Assortment Pack (2 MAX-A and 2 MAX-N sensors)	—	1	MAXPACI

OxiMax OxiCliq® Sensors: Reusable cable with adhesive sensor bandage

Description	Weight Range	Qty	Catalog #
OxiCliq Sensor Cable (3 ft)	—	1	OC-3
OxiCliq A, adult	>30 kg	Case of 24	A
OxiCliq N, neonatal/adult	<3 kg or >40 kg	Case of 24	N
OxiCliq P, pediatric	10 to 50 kg	Case of 24	P
OxiCliq I, infant	3 to 20 kg	Case of 24	I

OxiMax Reusable Sensors

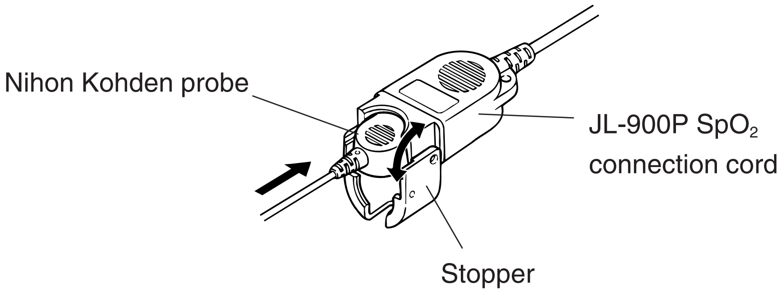
Description	Weight Range	Qty	Catalog #
Durasensor® DS-100A finger-clip sensor, adult	>40 kg	1	DS100A
Oxiband® OXI-A/N adult/neonatal	<3 kg or >40 kg	1	OXI-A/N
Oxiband OXI-P/I pediatric/infant	3 to 40 kg	1	OXI-P/I
Dura-Y® D-YS multisite sensor	>1 kg	1	D-YS
D-YSE ear clip for Dura-Y sensor	>30 kg	1	D-YSE
PediCheck™ D-YSPD pediatric spot-check sensor	3 to 40 kg	1	D-YSPD

Connecting Cables

Connecting Cable to the Monitor

1. Open the stopper of the SpO$_2$ connection cord and connect the probe firmly.

2. Close the stopper.

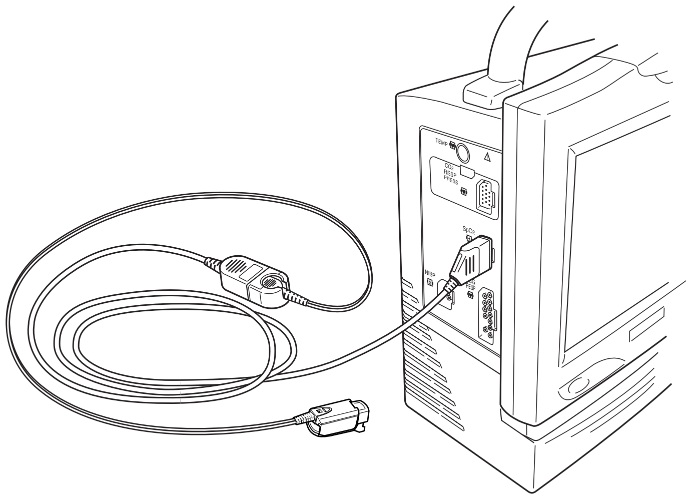


3. Connect the SpO$_2$ connection cord to the SpO$_2$ socket on the monitor.

CAUTION

When using Nellcor probes, do not touch the SpO$_2$ socket pins on the monitor with your finger when connecting or disconnecting the connection cord from the monitor. The monitor may malfunction or get damaged.

When using TL-201T Finger Probe on the BSM-2301/2351 Monitor



Attaching the Probe to the Patient

WARNING

- **Check the circulation condition by observing the skin color of the measuring site and pulse waveform. Change the measuring site every 8 hours for disposable probes and every 4 hours for reusable probes. The skin temperature may increase at the attached site by 2 or 3°C (4 or 5°F) and cause a burn or pressure necrosis. When using the probe on the following patients, take extreme care and change the measurement site more frequently according to symptoms and degree.**
  - **A patient with a fever**
  - **A patient with peripheral circulation insufficiency**
  - **Neonate or low birth weight infant with delicate skin**
- **When using the TL-201T finger probe, do not fasten the probe and cable to the finger by wrapping with tape. This may cause burn, congestion or pressure necrosis from poor blood circulation.**
- **When using probes other than the TL-201T finger probe, to avoid poor circulation, do not wrap the tape too tight. Check the blood circulation condition by observing the skin color and congestion at the skin peripheral to the probe attachment site. Even for short-term monitoring, there may be burn or pressure necrosis from poor blood circulation, especially on neonates or low birth weight infants whose skin is delicate. Accurate measurement cannot be performed on a site with poor peripheral circulation.**

CAUTION

- **When using Nellcor probes, read the instructions provided with the probe.**
- **If the attachment site is dirty with blood, clean the attachment site before attaching the probe. If there is nail polish on the attachment site, remove the polish. Otherwise, the amount of transmitted light decreases, and measured value may be incorrect or measurement cannot be performed.**
- **If the skin gets irritated or redness appears on the skin from the probe, change the attachment site or stop using the probe.**
- **Do not attach the probe to the same limb that is used for NIBP measurement or an IBP catheter.**
- **When attached, make sure that the light emitter and the photo detector of the probe face each other. Otherwise, SpO_2 cannot be measured properly.**
- **Do not reuse the disposable probes for another patient because it causes cross infection.**
- **Do not use the probe over its stated lifetime. Otherwise the SpO_2 measurement accuracy cannot be guaranteed.**
- **When the probe is attached on an appropriate site with sufficient circulation and the error message confirming the probe attachment repeatedly appears, the probe may be deteriorated. Replace it with a new one.**

- **Do not pull or bend the probe cable, and do not put caster feet on the probe cable. Do not immerse the probe cable in detergents or water. Failure to follow these cautions may cause cable discontinuity, short circuit, skin burn on the patient and incorrect measurement data. Replace any broken probe with a new one.**
- **Do not immerse the probe in detergents or water. If the probe adhesive surface gets wet, adhesiveness becomes weak and the probe cannot be attached to the skin.**
- **Refer to the probe instruction manual for details.**

NOTE

- **If the patient has long fingernails, cut the nail. The probe cannot be attached properly if the nail is long.**
- **Do not let the patient get tangled in the cable.**

The light-transmission type probe requires the light to penetrate tissue of 6 to 14 mm thick (e.g. finger or toe). The best monitoring condition is tissue approximately 10 mm thick.

Attach the probe to the patient referring to the probe's manual.

Monitoring SpO_2

When the preparation is done properly, the SpO_2 value and pulse waveform appear on the screen.

WARNING

- **Measurement may be incorrect in the following cases.**
  - **When the patient's carboxyhemoglobin or methemoglobin increases abnormally.**
  - **When dye is injected in the blood.**
  - **When using an electrical surgery unit.**
  - **During CPR.**
  - **When there is body movement.**
  - **When there is vibration.**
  - **When measuring at a site with venous pulse.**
  - **When the pulse wave is small (insufficient peripheral circulation).**
  - **When using an IABP (intra-aortic balloon pump).**
- **Check the circulation condition by observing the skin color of the measuring site and pulse waveform. Change the measuring site every 8 hours for disposable probes and every 4 hours for reusable probes. The skin temperature may increase at the attached site by 2 or 3°C (4 or 5°F) and cause a burn or pressure necrosis. When using the probe on the following patients, take extreme care and change the measurement site more frequently according to symptoms and degree.**
  - **A patient with a fever**
  - **A patient with peripheral circulation insufficiency**
  - **Neonate or low birth weight infant with delicate skin**
- **When using the TL-201T finger probe, do not fasten the probe and cable to the finger by wrapping with tape. This may cause burn, congestion or pressure necrosis from poor blood circulation.**
- **When using probes other than the TL-201T finger probe, to avoid poor circulation, do not wrap the tape too tight. Check the blood circulation condition by observing the skin color and congestion at the skin peripheral to the probe attachment site. Even for short-term monitoring, there may be burn or pressure necrosis from poor blood circulation, especially on neonates or low birth weight infants whose skin is delicate. Accurate measurement cannot be performed on a site with poor peripheral circulation.**
- **When not monitoring SpO_2, disconnect the SpO_2 connection cord from the monitor. Otherwise, noise may interfere from the probe sensor and incorrect data is displayed on the screen.**

CAUTION

- **When the probe is attached on an appropriate site with sufficient**

circulation and the error message confirming the probe attachment repeatedly appears, the probe may be deteriorated. Replace it with a new one.

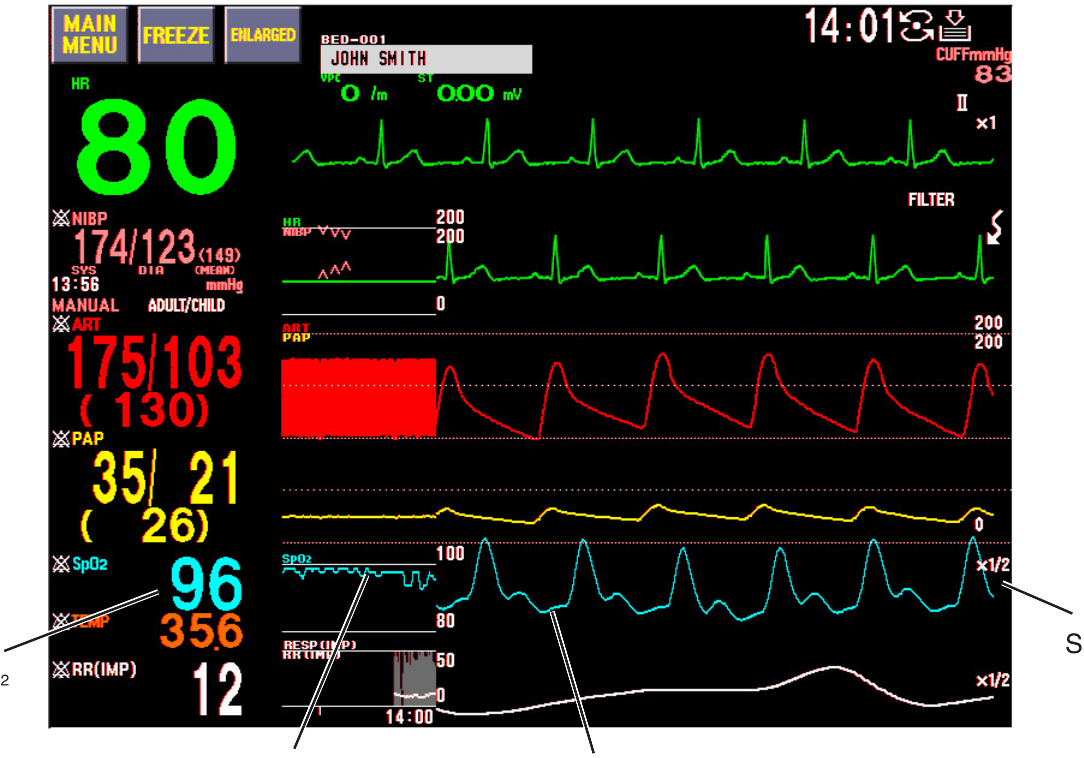
- **When the probe or SpO$_2$ connection cord failure message appears on the screen, replace it with a new one. Otherwise SpO$_2$ data may not be accurate.**

NOTE

In order to maintain sufficient blood circulation, keep the measurement site warm by covering with a blanket or something similar. Warming the site is effective, especially for a patient with a small pulse amplitude.

For error messages and monitoring problems, refer to Section 17.

SpO$_2$ Information on the Monitoring Screen


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
VPC 0 /m
ST 0.00 mV
14:01
CUFFmmHg 83
II ×1
HR 80
NIBP 174/123 (149)
SYS DIA (MEAN) mmHg
13:56
MANUAL ADULT/CHILD
FILTER
HR NIBP 200 200 0
ART PAP 200 200
ART 175/103 (130)
PAP 35/ 21 (26)
0
SpO2 96
100
80
×1/2
TEMP 35.6
RESP(IMP) RR(IMP) 50 0
14:00
RR(IMP) 12
×1/2

SpO$_2$

Sensitivity

SpO$_2$ trendgraph

SpO$_2$ pulse waveform

Detection and Display of Measurement Condition

CHECK PROBE Message (When the Finger Probe is Used)

This message is displayed highlighted with one “bong” sounding every 20 seconds and the yellow lamp lit when the SpO_2 connection cord is disconnected from the probe or SpO_2 socket on the monitor, the probe is not firmly attached to the patient, or the amount of transmitted light is too small for measurement.

Check the SpO_2 connection cord connection and firmly attach the probe to the patient or reposition the probe so that more light can pass through.

DETECTING PULSE Message

Displayed when the detected pulse waveform is too small.

After attaching the probe to the patient, it takes 10 to 20 seconds to automatically adjust the gain. When the pulse waveform is detected satisfactorily, the “DETECTING PULSE” message disappears and the SpO_2 value appears.

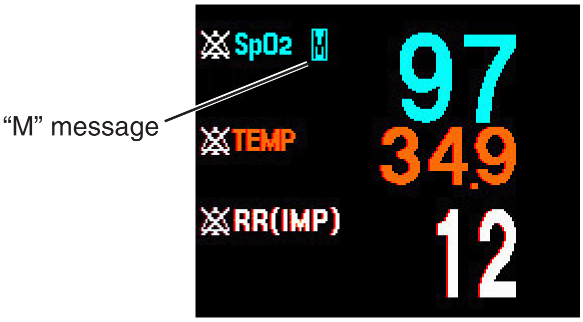
NOTE

When the “DETECTING PULSE” message is displayed for a long time, it means that the detected pulse is too small to measure. Reposition the probe.

M Message

Displayed when there is considerable body movement or the probe attachment is unstable. When the message is displayed frequently, check the patient condition, and if necessary, change the probe attachment site.

“M” stands for “Movement” or “Motion artifact”.



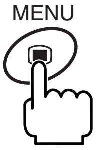
Changing SpO_2 Settings

Change settings on the SpO_2 window. The following settings can be changed for SpO_2 monitoring.

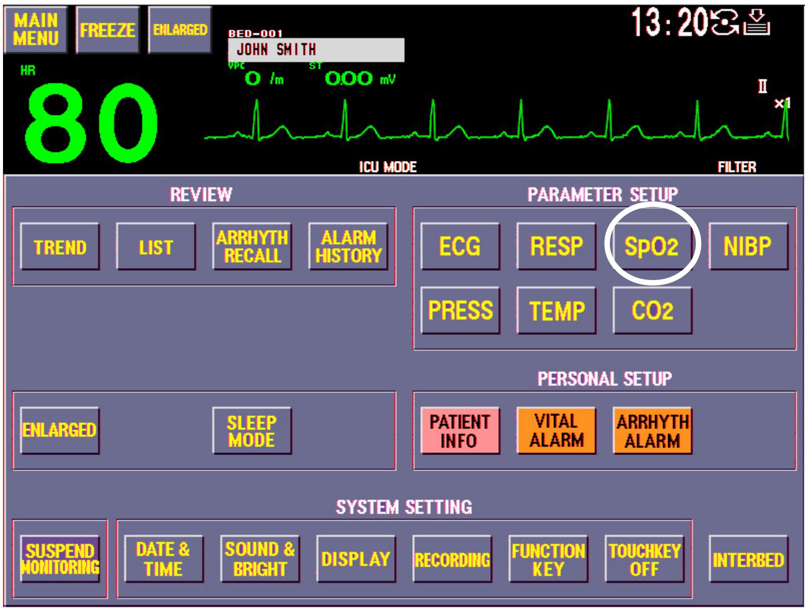
- Select the pulse wave sensitivity
- SpO_2 alarm threshold
- Changing the sync source
- Setting the pitch of the sync sound
- Select the response mode

Changing the Pulse Waveform Sensitivity

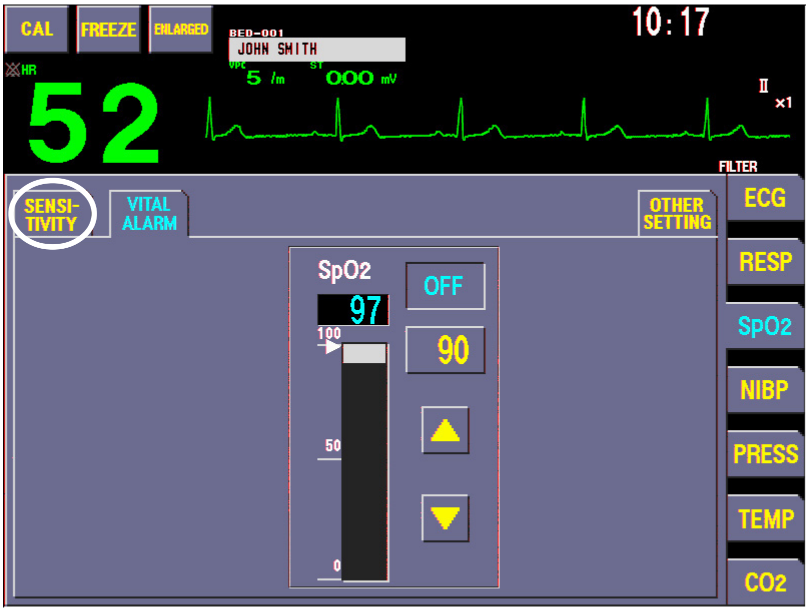
The sensitivity determines the size of the waveform on both the screen and recording paper.



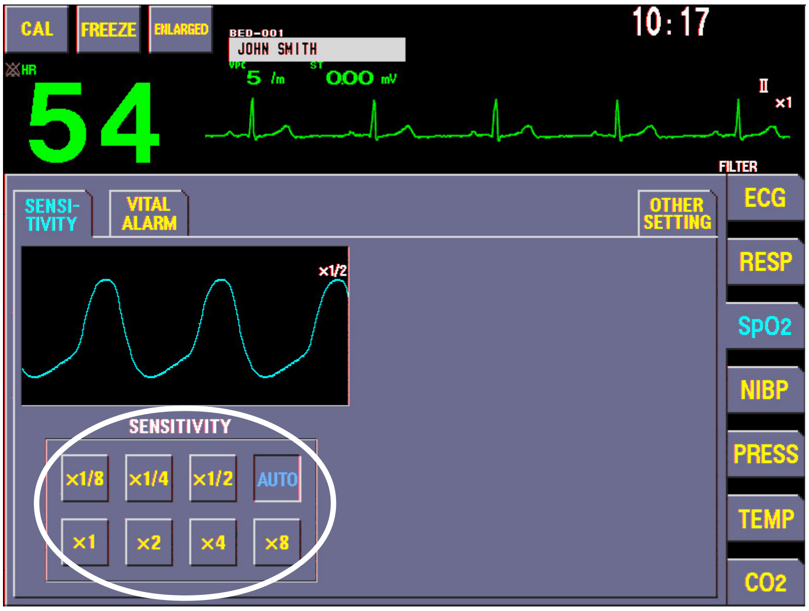
1. Press the MENU key on the front panel to display the MENU window.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC
0 /m
ST
0.00 mV
II
×1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

2. Touch the “SpO2” key. The SpO_2 VITAL ALARM window appears.

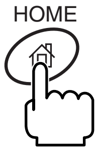

CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
10:17
HR
52
VPC
5 /m
ST
0.00 mV
II
×1
FILTER
SENSI-TIVITY
VITAL ALARM
OTHER SETTING
SpO2
97
OFF
90
100
50
0
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2

3. Touch the “SENSITIVITY” tab on the SpO$_2$ window.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
10:17
HR
54
VPC
5 /m
ST
0.00 mV
II
×1
FILTER
SENSI-TIVITY
VITAL ALARM
OTHER SETTING
×1/2
SENSITIVITY
×1/8
×1/4
×1/2
AUTO
×1
×2
×4
×8
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2

4. Select the sensitivity by touching the desired sensitivity in the SENSITIVITY box.

When “AUTO” is set, the sensitivity is automatically set so that the SpO$_2$ waveform with the optimum amplitude is displayed on the monitoring screen.



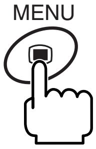
5. Press the HOME key on the front panel to return to the monitoring screen.

Changing the SpO_2 Alarm Limits

CAUTION

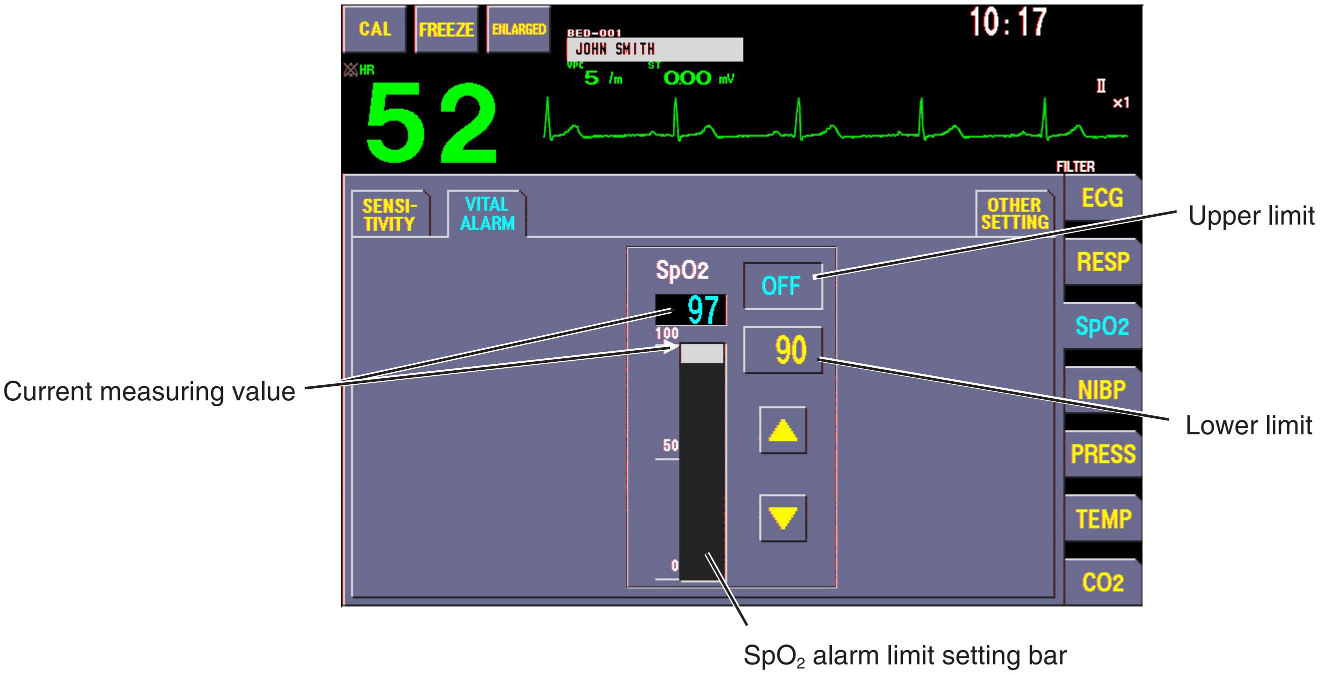
When the upper or lower alarm limit is turned off, there will be no SpO_2 upper or lower alarm for that limit.

You can set the upper and lower SpO_2 alarm limits on this window. Other alarm items must be set on the VITAL ALARM window. You can set all alarms, including the upper and lower SpO_2 alarm limits, on the VITAL ALARM window (See Section 6).



1. Press the MENU key on the front panel to display the MENU window.

2. Touch the “SpO_2” key. The SpO_2 VITAL ALARM window appears.

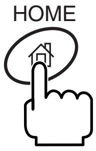

CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
10:17
HR
52
VPC 5 /m
ST 0.00 mV
II
x1
FILTER
SENSI-TIVITY
VITAL ALARM
OTHER SETTING
SpO2
OFF
97
100
90
50
0
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
Upper limit
Current measuring value
Lower limit

SpO_2 alarm limit setting bar

3. Touch the upper limit box to set the upper limit or touch the lower limit box to set the lower limit.

4. Touch the desired level on the setting bar. Touch the ▲ or ▼ key to adjust the setting.

   If the upper limit is set to a value above the maximum or the lower limit is set to a value below the minimum, the alarm is set to OFF.



5. Press the HOME key on the front panel to return to the monitoring screen.

Changing the Sync Source

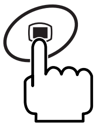
You can select ECG, SpO_2 pulse (SpO_2) or arterial blood pressure pulse (P1) as the sync source.

NOTE

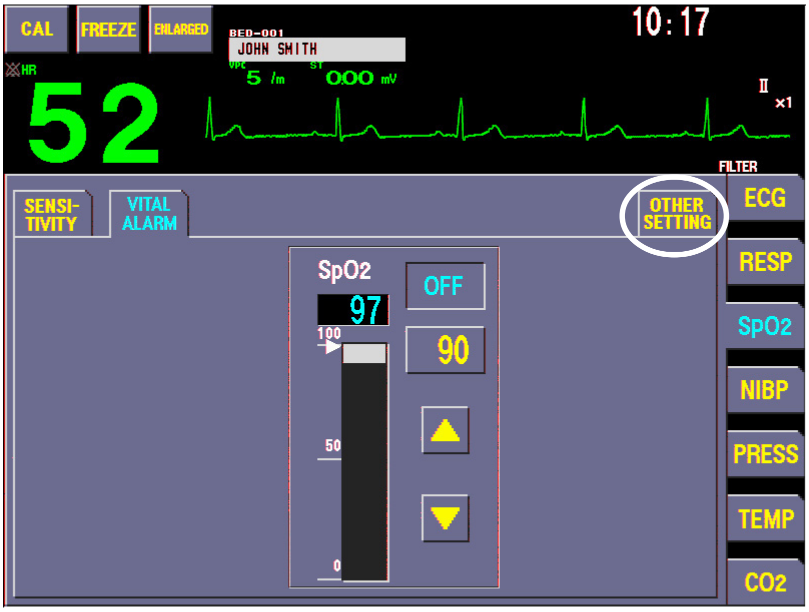
- **When pulse wave and pressure waveform are irregular because of an IABP, select ECG.**
- **When heart rate is unstable because of an electrosurgical unit, select SpO_2 or P1.**
- **When the connection cord of SpO_2 or IBP is disconnected from the monitor and alarm occurs when the sync source is set to SpO_2 or P1, the sync source changes to ECG when the alarm is silenced by pressing the SILENCE ALARMS key. The sync source returns to SpO_2 or P1 when the SpO_2 or IBP is monitored again.**
- **When the sensor is detached from the patient and alarm occurs, and the sync source is set to SpO_2 or P1, the sync source does not change to ECG when the alarm is silenced and PR is displayed "- - - ".**
- **On BSM-2304, to use P1 as the sync source, the IBP must be monitored by the PRESS1 socket.**

When the sync source is set to ECG and ECG is not measured, there is no sync sound.

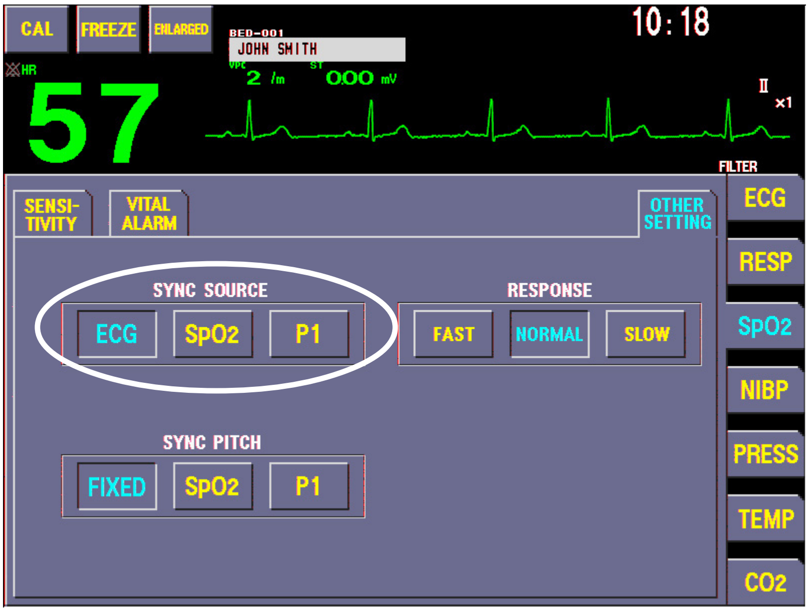
When SpO_2 or P1 is selected, the pulse rate is displayed instead of the heart rate on the screen.



1. Press the MENU key on the front panel to display the MENU window.
2. Touch the "SpO2" key. The SpO2 VITAL ALARM window appears.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
HR
52
VPC
5 /m
ST
0.00 mV
10:17
II
×1
FILTER
SENSI-TIVITY
VITAL ALARM
OTHER SETTING
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
SpO2
97
100
50
0
OFF
90

3. Touch the "OTHER SETTING" tab to display the OTHER SETTING window.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
10:18
HR
57
VPC
2 /m
ST
0.00 mV
II
×1
FILTER
SENSI-TIVITY
VITAL ALARM
OTHER SETTING
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
SYNC SOURCE
ECG
SpO2
P1
RESPONSE
FAST
NORMAL
SLOW
SYNC PITCH
FIXED
SpO2
P1

4. Touch the “ECG”, “SpO2” or “P1” key in the SYNC SOURCE box to select the sync source.

5. Press the HOME key on the front panel to return to the monitoring screen.

Selecting Sync Sound Pitch

The sync sound can be variable pitch or fixed pitch pips. The fixed pitch is high pitch as the default, but medium or low pitch can also be set. See Section 3. When you select variable pitch, the pitch of the sync sound changes according to SpO_2 value or systolic BP value of the arterial blood pressure.

When the variable pitch with SpO_2 value is selected, the pitch of the sync sound changes as follows.

SpO2 Value	Pitch of Sync Sound
100 to 81%	High to low pitch, in 1% steps
Less than 81%	Low pitch

When the variable pitch with systolic BP value is selected, the pitch of the sync sound changes as follows.

Systolic BP Value	Pitch of Sync Sound
Higher than 120 mmHg	High pitch
120 to 20 mmHg	High to low pitch, in 5 mmHg steps
Less than 20 mmHg	Low pitch

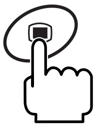
When the sync source is set to SpO_2 and the “CHECK PROBE”, “DETECTING PULSE” or “CHECK SENSOR” message appears on the screen, the sync sound stops.

When the sync source is set to ECG or P1, the sync pitch is set to SpO_2 and the “CHECK PROBE” or “DETECTING PULSE” message appears on the screen, the low pitch is selected automatically.

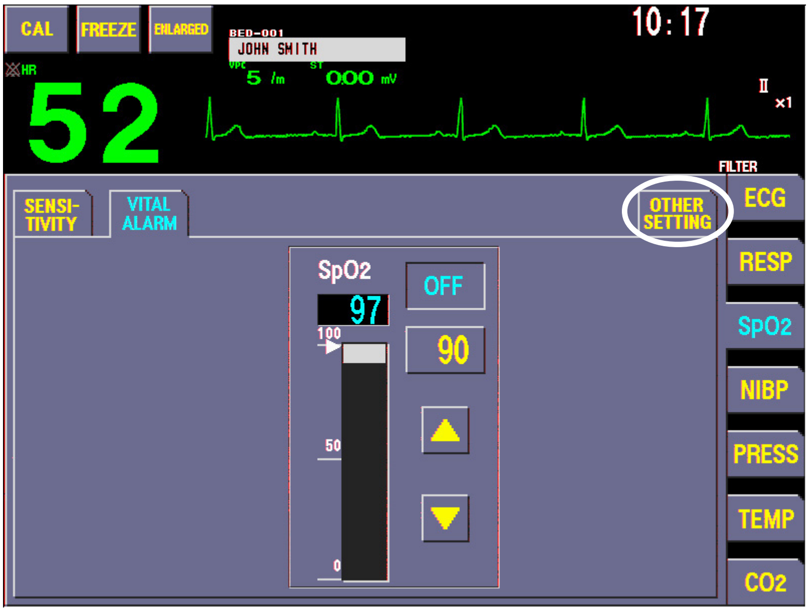
When the SpO_2 connection cord or IBP connection cord is disconnected from the monitor, ECG is automatically selected as the sync source.

NOTE

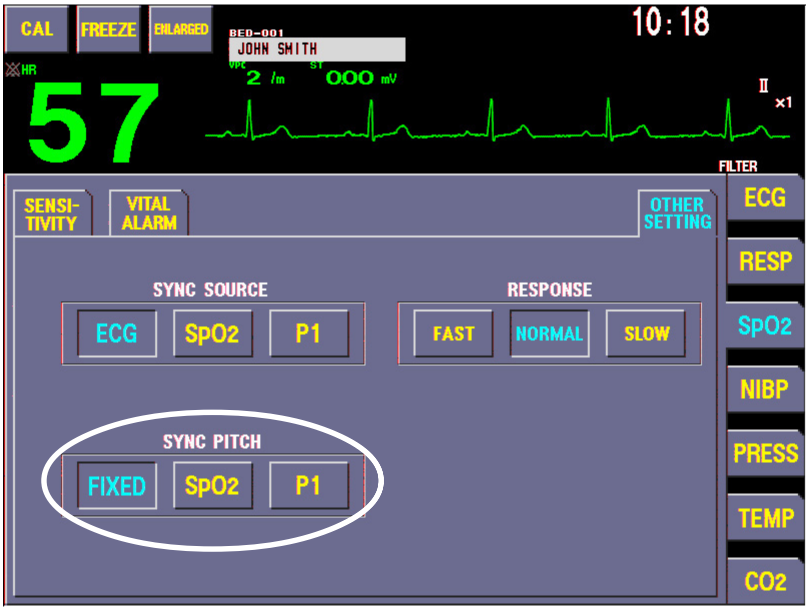
On BSM-2304, to vary the pitch according to P1, IBP must be monitored by the PRESS1 socket.



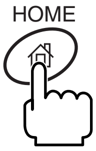
1. Press the MENU key on the front panel to display the MENU window.
2. Touch the “SpO2” key. The SpO_2 VITAL ALARM window appears.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
10:17
HR
52
VPC
5 /m
ST
0.00 mV
II
×1
FILTER
SENSI-TIVITY
VITAL ALARM
OTHER SETTING
SpO2
97
OFF
90
100
50
0
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2

3. Touch the “OTHER SETTING” tab to display the OTHER SETTING window.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
10:18
HR
57
VPC
2 /m
ST
0.00 mV
II
×1
FILTER
SENSI-TIVITY
VITAL ALARM
OTHER SETTING
SYNC SOURCE
ECG
SpO2
P1
RESPONSE
FAST
NORMAL
SLOW
SYNC PITCH
FIXED
SpO2
P1
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2

4. Touch the “FIXED”, “SpO2” or “P1” key in the SYNC PITCH box to select the sync pitch.

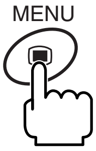


5. Press the HOME key on the front panel to return to the monitoring screen.

Selecting the Response Mode

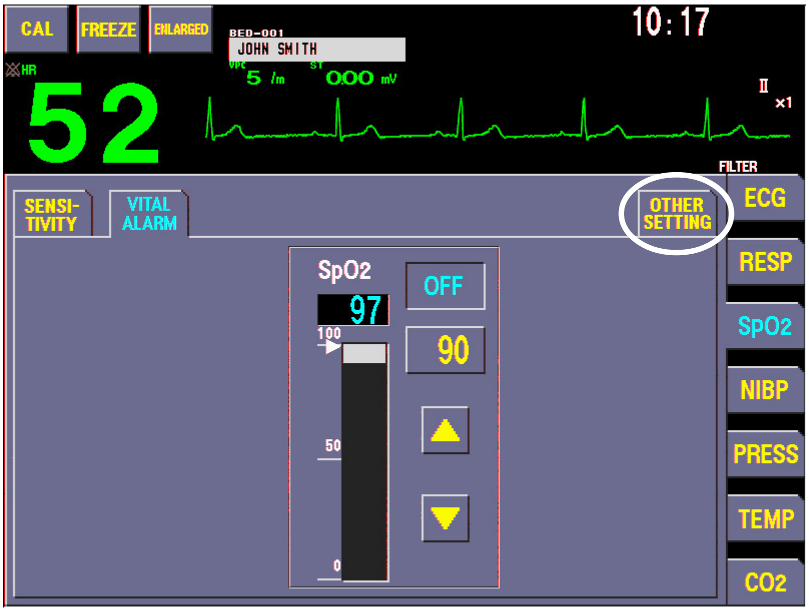
There are three response modes. Each response mode uses a different time to enable accurate measurements according to patient conditions. When measurement condition is unstable, response becomes slower in all modes.

FAST:	Select this mode for special applications that require a fast response. “FAST” is suitable for detecting short apnea.
NORMAL:	For normal monitoring.
SLOW*:	Select this mode when you need to suppress a rapid change in SpO$_2$. * This mode is not available on the BSM-2304 monitor.

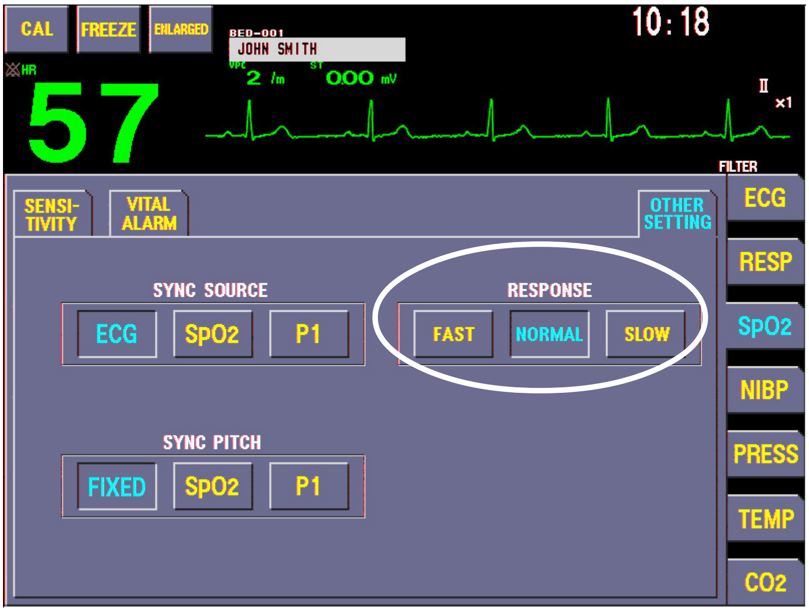


1. Press the MENU key on the front panel to display the MENU window.

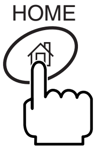
2. Touch the “SpO2” key. The SpO$_2$ VITAL ALARM window appears.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
10:17
HR
52
VPC 5 /m
ST 0.00 mV
II ×1
FILTER
SENSI-TIVITY
VITAL ALARM
OTHER SETTING
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
SpO2
97
OFF
90
100
50
0

3. Touch the “OTHER SETTING” tab to display the OTHER SETTING window.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
10:18
HR
57
VPC
2 /m
ST
0.00 mV
II
×1
FILTER
SENSI-TIVITY
VITAL ALARM
OTHER SETTING
SYNC SOURCE
ECG
SpO2
P1
RESPONSE
FAST
NORMAL
SLOW
SYNC PITCH
FIXED
SpO2
P1
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2

4. Touch the “FAST”, “NORMAL” or “SLOW” key in the RESPONSE box to select the response mode. The SLOW mode is not available on the BSM-2304 monitor.



5. Press the HOME key on the front panel to return to the monitoring screen.

Section 13 NIBP Monitoring

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Preparing for NIBP Measurement 13.2
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The NIBP measuring method in this monitor is licensed from Critikon Inc., U.S.A.

General

Non-invasive blood pressure is measured by wrapping the cuff on the patient and connecting the cuff to the NIBP socket on the monitor. In this monitor, noninvasive blood pressure is measured by the oscillometric method.

Oscillometric Method

The NIBP is measured from the change in amplitude pattern of pulsatile oscillation in cuff pressure as the cuff pressure is reduced from above systolic to below diastolic pressure. The occlusive-oscillometry method uses this to determine the systolic, diastolic, and mean arterial pressure.

The systolic pressure is the pressure at which the pulsatile oscillation suddenly increases, and the diastolic pressure is the pressure at which the pulsatile oscillation suddenly decreases. The mean arterial pressure is the point where maximum pulsatile oscillation occurs.

Measurement Modes

There are three modes for NIBP measurement on this monitor. Refer to the "Selecting the Measurement Mode and Interval" section.

• Single measurement	Measurement is performed once.
• STAT (Continuous) measurement	Measurement is performed for 15 minutes continuously.
• Automatic measurement	Measurement is performed automatically at preset time intervals. The time interval can be selected. Automatic measurement can also be performed with PWTT (available only on the BSM-2301/2351 monitor).

WARNING

- **Be careful when measuring NIBP on a patient with known bleeding disorders or congestion. After NIBP measurement, there may be dot hemorrhage, or circulatory disorder by thrombus where cuff is attached.**
- **When attaching the cuff to a premature infant at an early stage after birth, periodically change the cuff position to avoid possible skin erosion and fissure.**

CAUTION

Do not wrap the cuff on the arm or thigh which is used for injection. NIBP measurement on an arm or thigh which is used for injection may cause a reflux of blood and stop injection.

Preparing for NIBP Measurement

Preparation Flowchart

1. Select the cuff.
2. Connect the cuff to the air hose and air hose to the NIBP socket on the monitor.
3. Attach the cuff to the patient.
4. Set necessary settings.
5. Start measurements.
   For handling accessories after use, refer to Section 18.

Selecting the Cuff

CAUTION

- **Only use the specified cuff. Otherwise NIBP monitoring cannot be performed properly or the monitor may be damaged.**
- **Select the cuff which fits each patient. If the cuff size is not correct, measurement may not be completed or the result may be incorrect.**

Select the appropriate cuff according to the purpose.

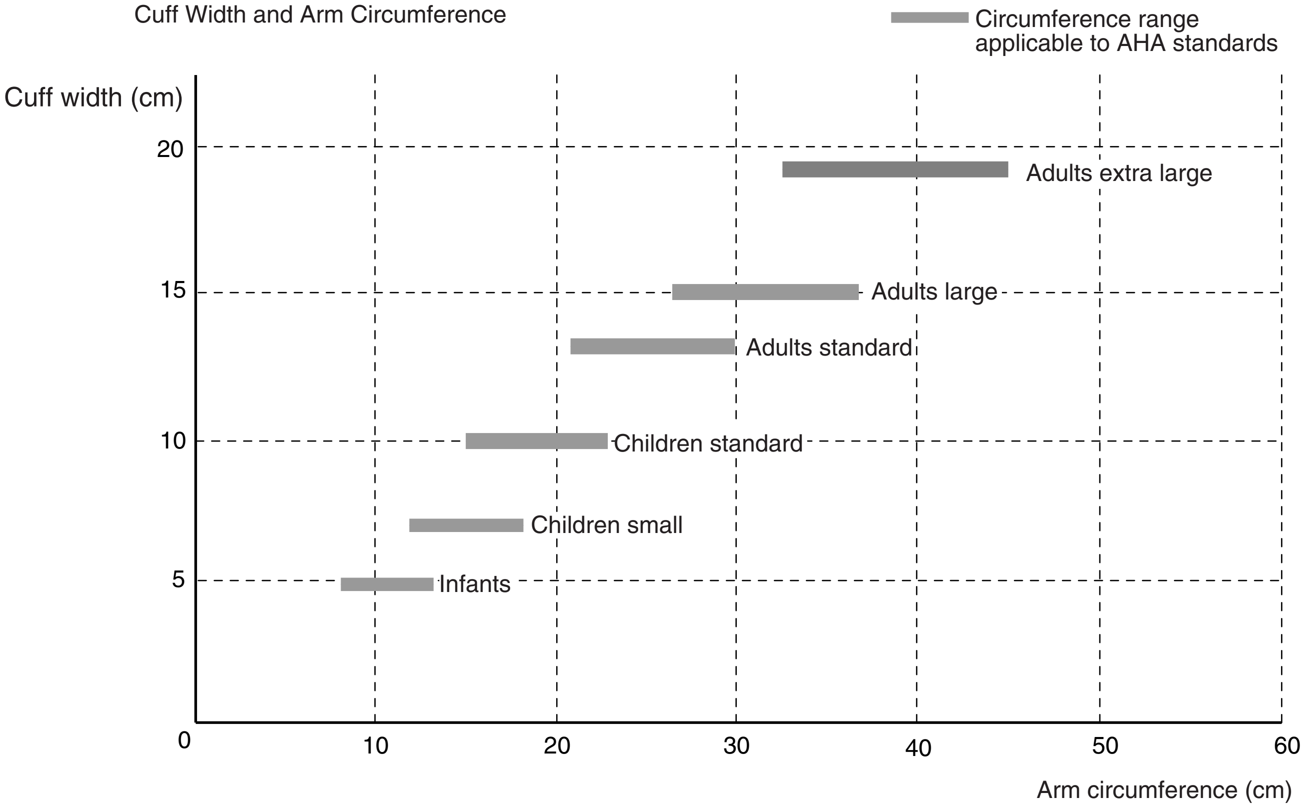
The AHA (American Heart Association) recommends that the cuff width be 40% of the circumference of the upper arm. Refer to the following graph and select the cuff which suits the patient's arm.

NOTE

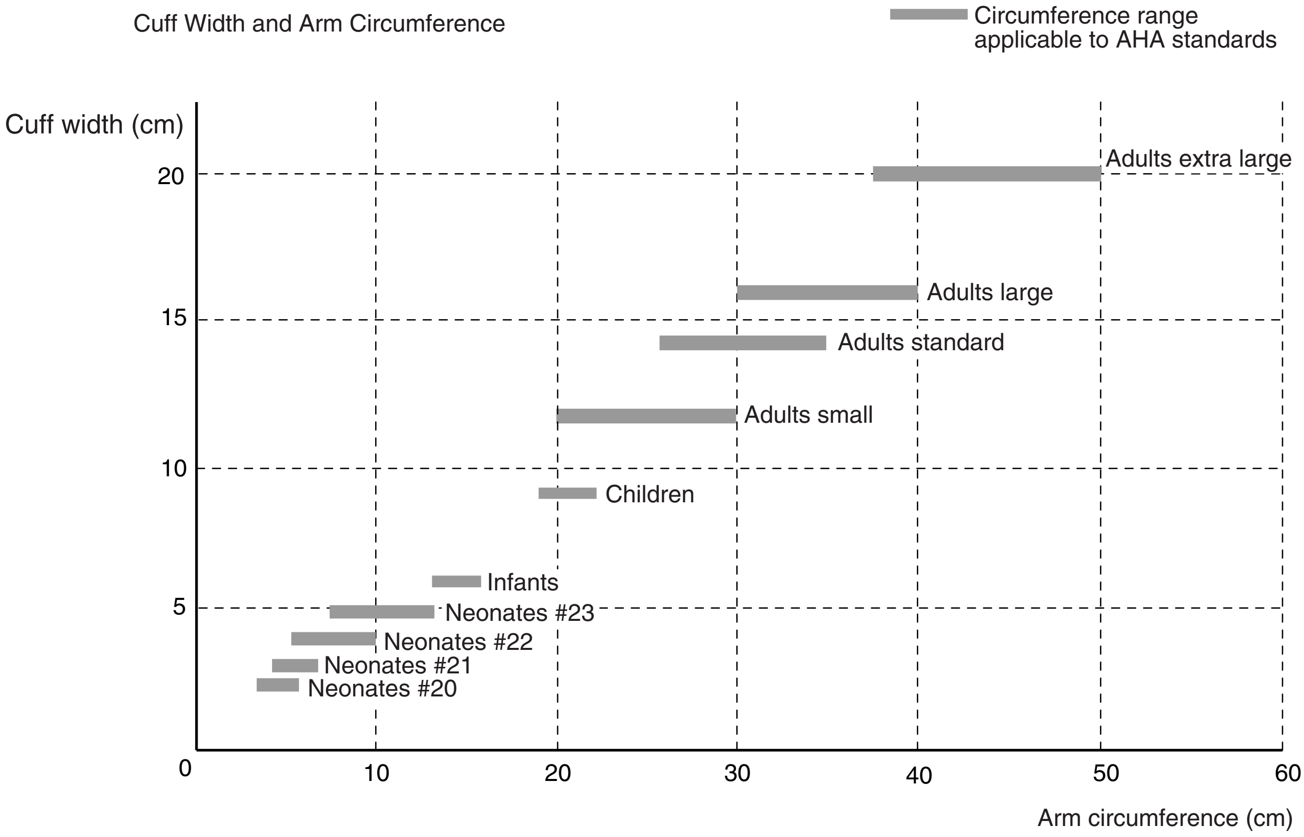
- **If the range of arm circumference appropriate for the cuff is prescribed, use within that range.**
- **To obtain accurate measured values, select a wide cuff which can be attached to the upper arm or the thigh (calf in the case of neonates). Measuring with a very narrow cuff may result in measured values higher than the actual values.**

Cuff Width and Arm Circumference

YP-950T/951T/952T/953T/954T/955T/960T/961T/962T/963T/964T/965T cuffs



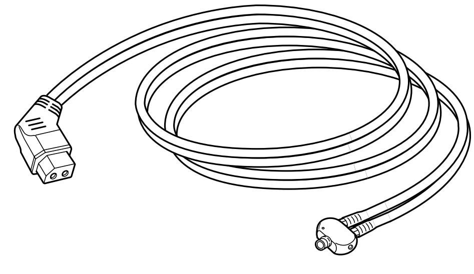
YP-910P/912P/913P/914P/915P/916P/920P/921P/922P/923P cuffs



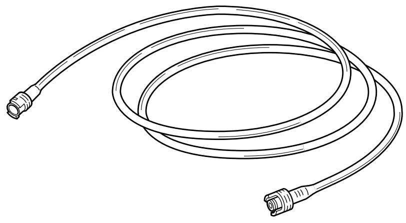
Types of Cuffs

Reusable Cuffs

When using the following reusable cuffs, a YN-900P (1.5 m) or YN-901P (3.5 m) air hose is required. A YN-990P (1.5 m) extension hose is also available.

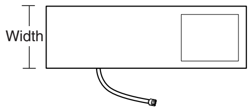
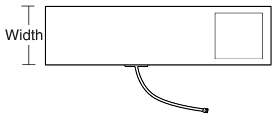


YN-900P Air hose

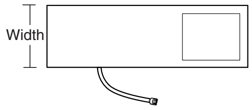
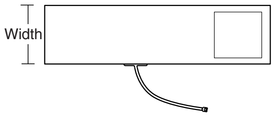


YN-990P Extension hose

For the YP-960T/961T/962T/963T/964T/965T reusable cuffs, the cloth cover can be separated from the rubber hose so that the cloth cover can be washed. The rubber hose is latex-free.

Cuff			Width (cm)	Applicable circumference (cm)	Shape
For infants		YP-960T	5	8 to 13	
For children	Small	YP-961T	7	12 to 18	
	Standard	YP-962T	10	15 to 23	
For adults	Standard	YP-963T	13	21 to 30	
	Large	YP-964T	15	26 to 36	
For thigh		YP-965T	19	33 to 45	

For the YP-950T/951T/952T/953T/954T/955T reusable cuffs, the cloth cover can be separated from the rubber hose so that the cloth cover can be washed. The rubber hose contains natural rubber latex.

Cuff			Width (cm)	Applicable circumference (cm)	Shape
For infants		YP-950T*	5	8 to 13	
For children	Small	YP-951T*	7	12 to 18	
	Standard	YP-952T*	10	15 to 23	
For adults	Standard	YP-953T*	13	21 to 30	
	Large	YP-954T*	15	26 to 36	
For thigh		YP-955T*	19	33 to 45	

CAUTION

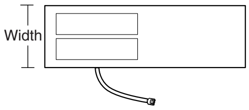
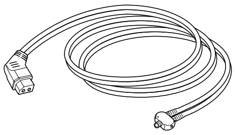
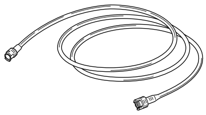
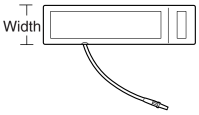
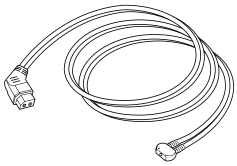
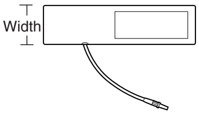
*** These Products Contain Natural Rubber Latex Which May Cause Allergic Reactions.**

Natural rubber may cause allergic reaction with symptoms such as itching, redness, urticaria, swelling, fever, dyspnea, symptoms similar to asthma, reduced blood pressure and shock. If the patient shows any of the above symptoms, immediately stop using the cuff and perform appropriate medical treatment.

Disposable Cuffs

CAUTION

- **Do not sterilize the non-sterilized disposable cuffs for neonates.**
- **Do not reuse disposable cuffs.**

Cuff			Width (cm)	Applicable circumference (cm)	Shape	Air Hose
Infants (Non-sterilized)		YP-910P	6	13 to 16		YN-900P (1.5 m) YN-901P (3.5 m)  Extension hose YN-990P (1.5 m) 
Children (Non-sterilized)		YP-912P	9	19 to 22.5		
Adults (Non-sterilized)	Small	YP-913P	12	20 to 30		
	Standard	YP-914P	14	23 to 35		
	Large	YP-915P	16	30 to 40		
	Extra large	YP-916P	20	38 to 50		
Neonates (Non-sterilized)	#20	YP-920P	2.5	3 to 6		YN-920P (1.5 m) YN-921P (3.5 m) 
	#21	YP-921P	3	4 to 7.5		
	#22	YP-922P	4	5.5 to 10		
	#23	YP-923P	5	7 to 13		
Neonates (Sterilized)		No. 11*	3	5 to 7.5		
		No. 12*	4	7.5 to 10.5		
		No. 13*	5	8.5 to 13		

* These parts have not been checked for compliance with the MDD (Medical Device Directive). For EC member countries, Nihon Kohden recommends the use of parts that comply with MDD.

If necessary, sterilize the disposable cuffs for infants, children and adults using glutaraldehyde solution by following its instructions.

The non-sterilized disposable cuffs for neonates cannot be sterilized. If necessary, use sterilized disposable cuffs for neonates.

Disinfecting Disposable Cuffs before Use

If necessary, disinfect the cuffs before use. The disposable cuffs for neonates cannot be disinfected.

NOTE

Do not let water get inside the cuff. If water gets inside the cuff, use a new one.

1. Wipe the cuff with a cloth moistened with neutral soap water or isopropyl alcohol.

   When soap water is used, rinse the cuff thoroughly with water.

2. Immerse the cuff in a disinfectant solution. Refer to the disinfectant instructions.
3. Rinse the cuff thoroughly with a sterilized solution.
4. Dry the cuff at room temperature. Do not heat the cuff.

Connecting Cables and Attaching the Cuff to the Patient

Connecting Air Hose and Cuff to the Monitor

CAUTION

Confirm that the air hoses are firmly connected between the sockets and hoses of the cuff. If not connected properly (the air hose connector clicks when properly inserted into the socket), the cuff cannot be correctly identified and air leakage will cause incorrect NIBP data or no data.

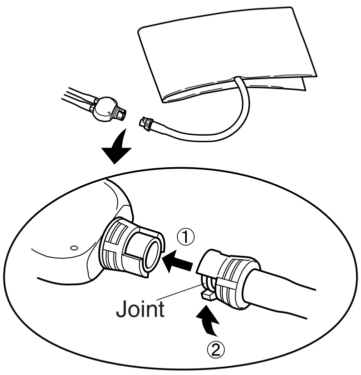
NOTE

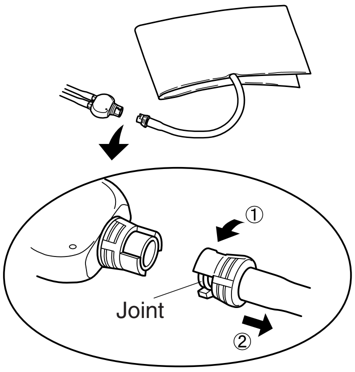
Before using the cuff, check and confirm that there is no flaw, crack or hole on the cuff. If the rubber cuff is cracked, has a hole or is not elastic, it may burst.

1. Connect the cuff to the air hose.

   Connecting the Cuff for Adults and Children

   Insert the cuff connector joint into the air hose and turn it clockwise until it clicks.



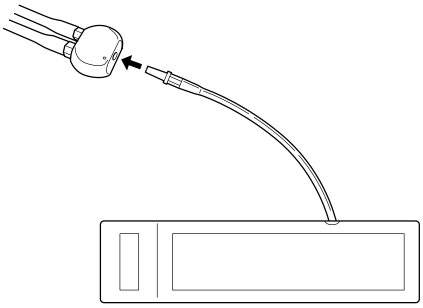


To disconnect the cuff from the air hose, turn the cuff connector joint counterclockwise to unlock it and remove it from the air hose.

NOTE

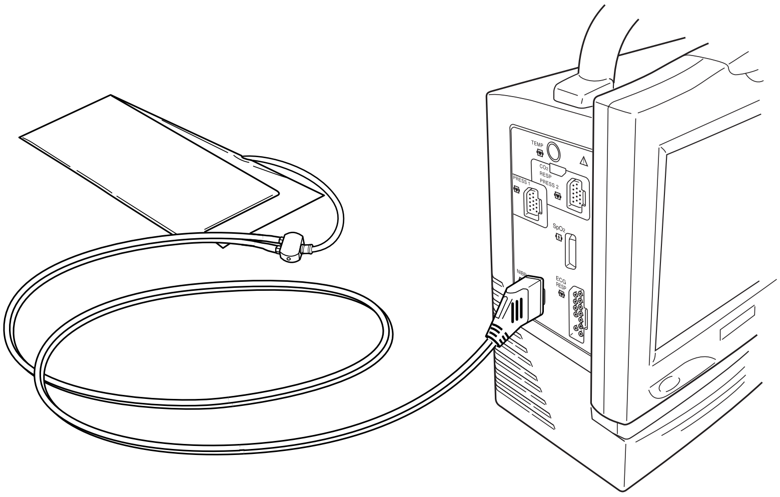
Do not apply excessive force to the joint, for example, stepping on it or pulling it with a clamp or pliers.

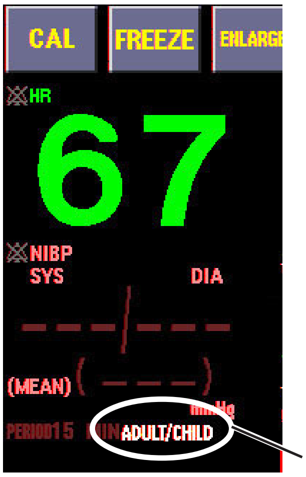
Connecting the Cuff for Neonates



2. Connect the air hose to the NIBP socket on the monitor.

   The monitor automatically identifies the type of the connected cuff (subject of measurement), and displays it on the NIBP window.





Cuff type

3. Check that the correct type of cuff is displayed on the monitoring screen.

   When using cuff for adults or children, “ADULT/CHILD” appears on the screen. When using cuff for neonates, “NEONATE” appears on the screen.

Attaching the Cuff to the Patient

How to Wrap the Cuff

WARNING

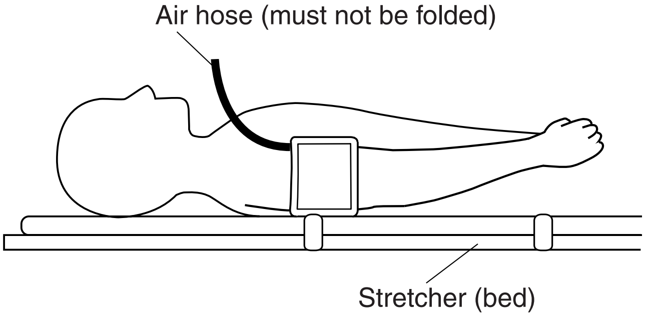
- **When attaching the cuff to a premature infant at an early stage after birth, periodically change the cuff position to avoid possible skin erosion and fissure.**
- **Be careful when measuring NIBP on a patient with known bleeding disorders or congestion. After NIBP measurement, there may be dot hemorrhage, or circulatory disorder by thrombus where cuff is attached.**

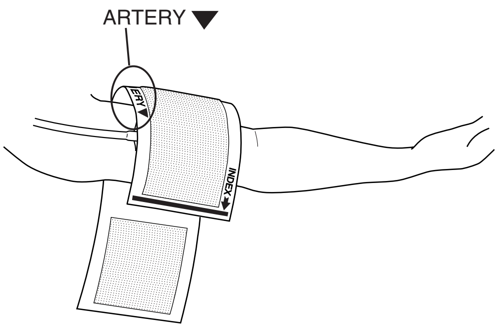
CAUTION

Do not wrap the cuff to the arm or thigh which is used for injection. NIBP measurement on an arm or thigh which is used for injection may cause a reflux of blood and stop injection.

When wrapping the cuff around the upper arm, observe the following points.

- The cuff must not wrap around the elbow.
- The cuff should just wrap around the upper arm, not too tightly or too loosely. A tightly wrapped cuff can cause discomfort to the patient and decreases pressure reading, and a loosely wrapped cuff prolongs the measurement time and increases the blood pressure reading. If the cuff pressure does not increase, the monitor will automatically stop inflating in 180 seconds (90 seconds when measuring a neonate) and stop the measuring procedure for patient safety.
- To prevent external vibration from affecting the measurement, the cuff and the cuff hoses should not touch the stretcher or the stretcher’s railing. Use an elbow rest (any soft object) to support the cuffed arm naturally and to keep the cuff from touching the stretcher.
- The air hose must not be folded or kinked.
- In principle, the cuff should be wrapped around a bare upper arm. Thick clothing can damp the pulsatile oscillation of the cuff pressure. It is still possible to obtain a measurement if the cuff is wrapped around thin clothing over the upper arm.
- Measurement values at other sites differ from the values at the upper arm. When NIBP measurement is important, NIBP must be measured at the upper arm.


Air hose (must not be folded)
Stretcher (bed)

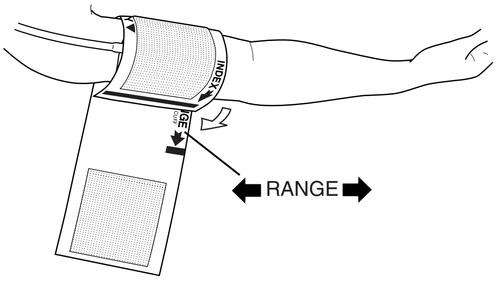


When Using the YP-950T/951T/952T/953T/954T/955T/960T/961T/962T/963T/964T/965T Reusable Cuffs

1. Put the cuff on the upper arm so that the ▼ mark of the "ARTERY ▼" aligns with the artery of the patient.

NOTE

The cuff must not wrap around the elbow.



2. Wrap the cuff so that the "INDEX ➡" comes within the "⬅ RANGE ➡".

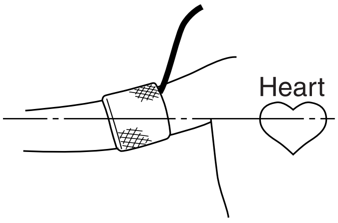
   If the "INDEX ➡" is not within the "⬅ RANGE ➡", change the cuff size.

Cuff Hose and Air Hose

Confirm that the hoses are not folded, kinked or squeezed.

CAUTION

When too much pressure is applied to the cuff, or the hose is folded or kinked, the "NIBP SAFETY CIRCUIT RUNNING" message appears on the screen and NIBP monitoring may be stopped. Remove the cause, wait for 40 seconds, check that the message disappears, then measure again.



Cuff Position (Height of Cuff from Heart Level)

Place the cuffed upper arm (brachium) at the same height as the patient's heart. If the cuff is not at the same level as the heart, the weight of the blood affects the blood pressure reading. The pressure difference per unit height is 0.7 mmHg/cm. The blood pressure reading decreases when the arm is higher than the heart and increases when lower.

The best measuring condition is when the patient is lying on his/her back with arms and legs relaxed. If the cuff position cannot be on the same level as the heart, the displayed blood pressure reading must be mathematically adjusted.

Changing NIBP Settings

NOTE

To change settings for monitoring neonate NIBP, the cuff for neonates must be connected to the cuff socket.

Change settings on the NIBP window. The following settings can be changed for monitoring NIBP.

- Initial cuff inflation pressure
- Measurement mode and interval
- NIBP alarm limits
- Measurement interval which can be called up by the ⏲ NIBP INTERVAL key
- Automatic measurement with PWTT on/off and trigger threshold (PWTT is available only on the BSM-2301/2351 monitor)

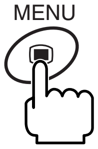
The following items can be set on the SYSTEM SETUP screen. Refer to Section 3.

- Measurement completion sound on or off.
- STAT measurement mode (STAT or 1 minute interval).
- Measurement mode after STAT (continuous) measurement.
- Time after NIBP measurement for the NIBP data to become dark
- Measurement mode after the monitor power is off for more than 30 minutes or the monitor is initialized

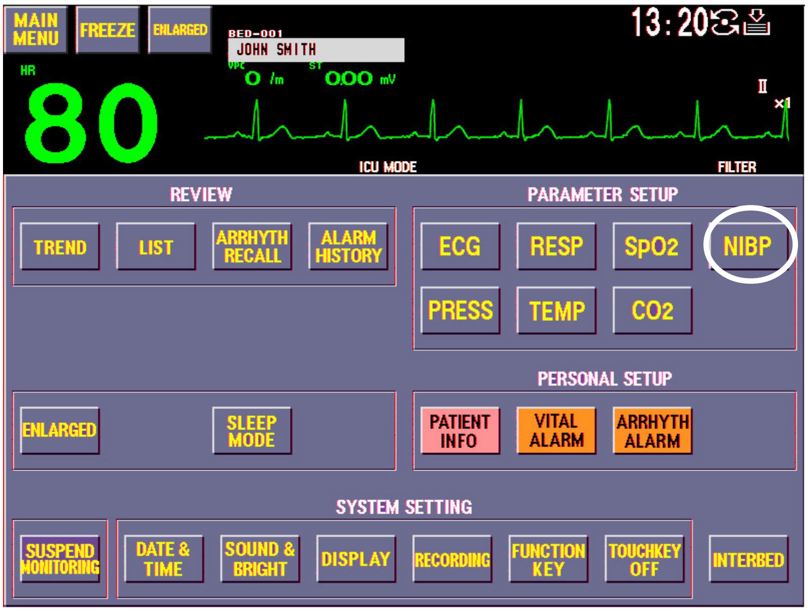
The NIBP unit (mmHg or kPa) is the same as the pressure unit. The pressure unit is set on the SYSTEM SETUP screen. Refer to Section 3.

Selecting the Initial Cuff Inflation Pressure

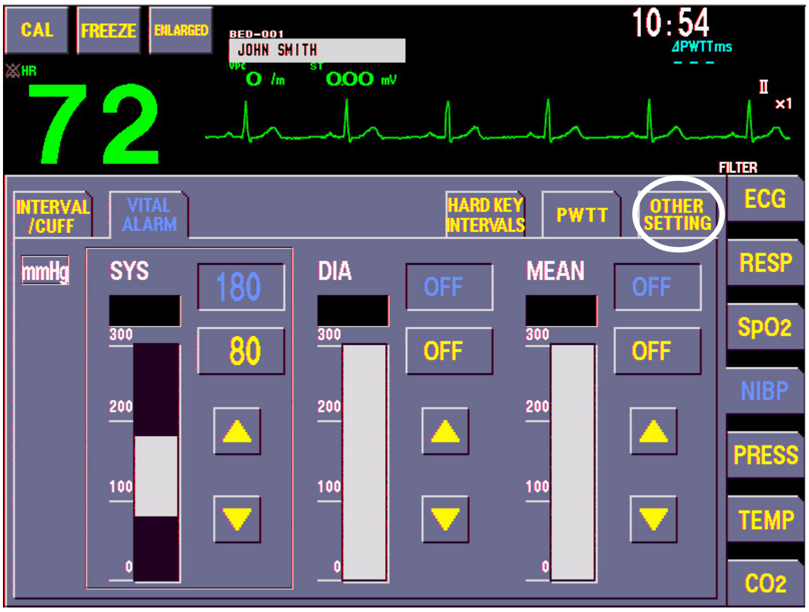
The initial cuff inflation pressure changes to the factory default setting when the air hose is disconnected from the NIBP socket on the monitor.



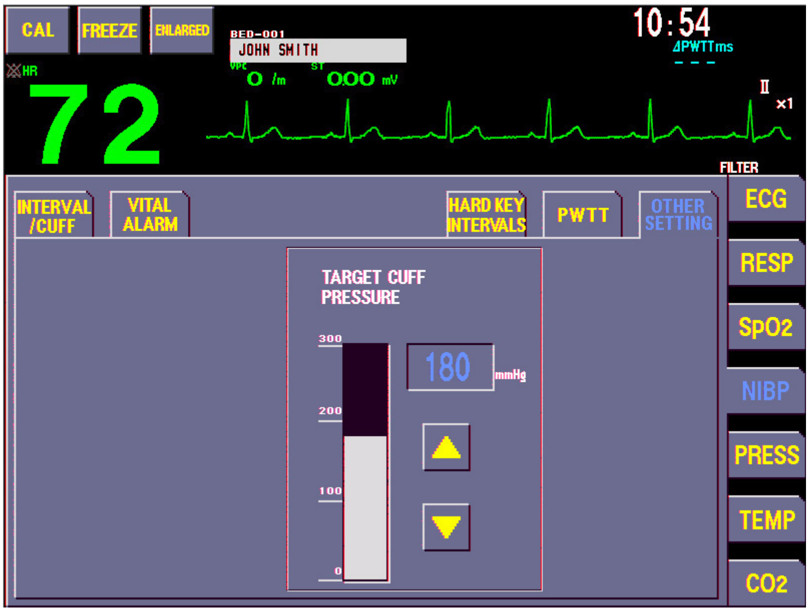
1. Press the MENU key on the front panel to display the MENU window.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC
0 /m
ST
0.00 mV
II
×1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
ENLARGED
SLEEP MODE
PERSONAL SETUP
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

2. Touch the “NIBP” key. The NIBP VITAL ALARM window appears.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
10:54
ΔPWTTms
HR
72
VPC
0 /m
ST
0.00 mV
II
×1
FILTER
INTERVAL /CUFF
VITAL ALARM
HARD KEY INTERVALS
PWTT
OTHER SETTING
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
mmHg
SYS
180
80
DIA
OFF
OFF
MEAN
OFF
OFF
300
200
100
0

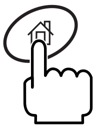
3. Touch the “OTHER SETTING” tab to display the OTHER SETTING window.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
10:54
ΔPWTTms
HR
72
VPC
0 /m
ST
0.00 mV
II
×1
FILTER
INTERVAL /CUFF
VITAL ALARM
HARD KEY INTERVALS
PWTT
OTHER SETTING
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
TARGET CUFF PRESSURE
300
200
100
0
180
mmHg

4. Change the setting. The default setting is 180 mmHg for adult and 100 mmHg for neonate. After the first measurement, the cuff inflation pressure is the systolic value of the previous measurement plus 30 mmHg.

Patient Type	Setting Range (10 mmHg/step)	Default Setting
Adult/Child	100 to 280	180
Neonate	70 to 120	100

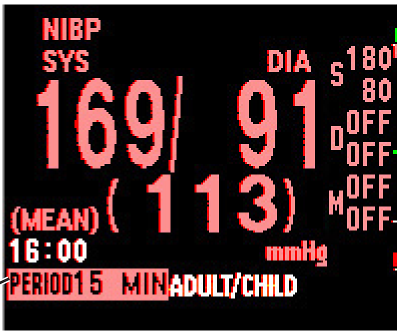
Touch the desired level on the setting bar. Touch the ▲ or ▼ key to adjust the setting.



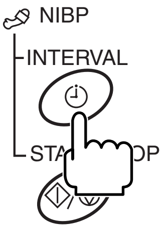
5. Press the HOME key on the front panel to return to the monitoring screen.

Selecting the Measurement Mode and Interval

The measurement mode and interval can be changed by pressing the ◷ NIBP INTERVAL key on the front panel. It can also be changed on the NIBP window on the screen.

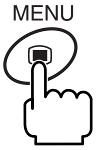

NIBP
SYS
DIA
169/ 91
(MEAN) (113)
16:00
mmHg
S 180 80
D OFF OFF
M OFF OFF
PERIOD 15 MIN
ADULT/CHILD

Measurement mode


NIBP
INTERVAL
START/STOP

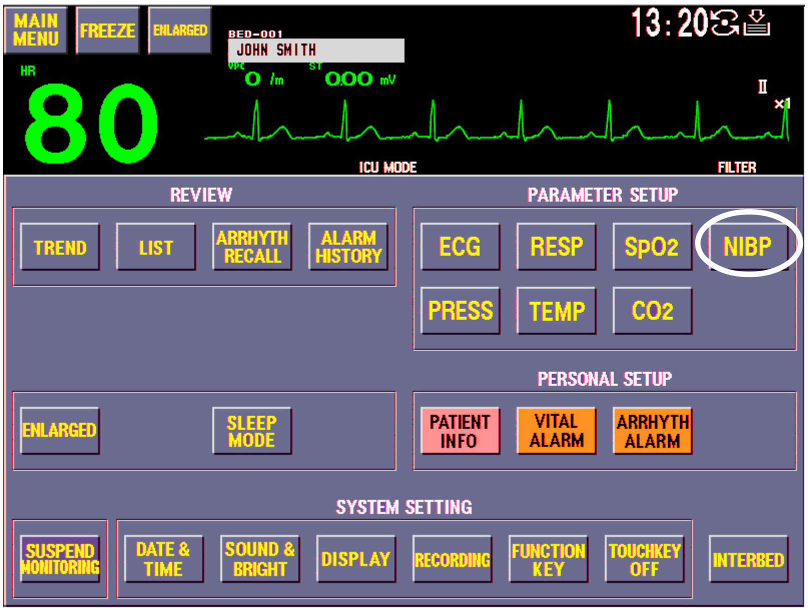
When the ◷ NIBP INTERVAL key on the front panel is pressed, the measurement mode changes according to the modes selected on the HARD KEY INTERVALS window. MANUAL mode is already selected for the mode selection. To select the modes for the ◷ NIBP INTERVAL key, refer to the "Selecting the Measurement Modes for the Mode Selection by the ◷ NIBP INTERVAL Key" section.

When the monitor is initialized or the monitor power is turned off for more than 30 minutes, the measurement mode changes to the mode selected for the NIBP INTERVAL MASTER on the SYSTEM SETUP screen . Refer to Section 3.

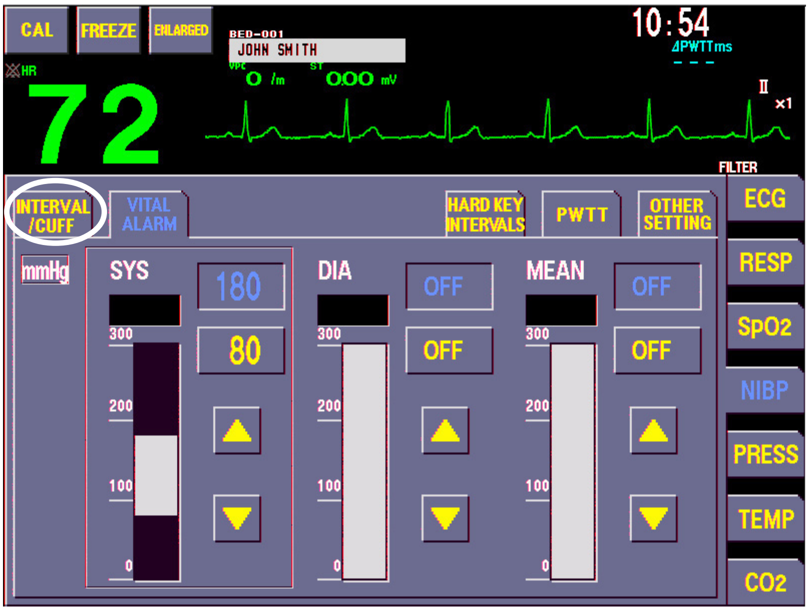


To change the measurement mode on the NIBP window:

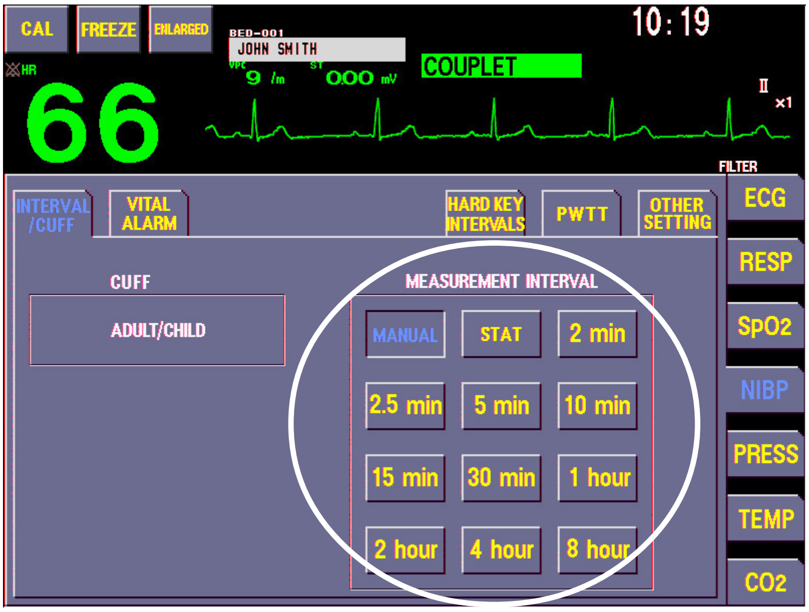
1. Press the MENU key on the front panel to display the MENU window.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC 0 /m
ST 0.00 mV
II
×1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

2. Touch the “NIBP” key. The NIBP VITAL ALARM window appears.

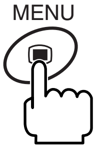

CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
10:54
ΔPWTTms
HR
72
VPC 0 /m
ST 0.00 mV
II ×1
FILTER
INTERVAL /CUFF
VITAL ALARM
HARD KEY INTERVALS
PWTT
OTHER SETTING
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
mmHg
SYS
180
80
DIA
OFF
OFF
MEAN
OFF
OFF
300
200
100
0

3. Touch the “INTERVAL/CUFF” tab to display the INTERVAL/CUFF window.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
10:19
COUPLET
HR
66
VPC 9 /m
ST 0.00 mV
II ×1
FILTER
INTERVAL /CUFF
VITAL ALARM
HARD KEY INTERVALS
PWTT
OTHER SETTING
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
CUFF
ADULT/CHILD
MEASUREMENT INTERVAL
MANUAL
STAT
2 min
2.5 min
5 min
10 min
15 min
30 min
1 hour
2 hour
4 hour
8 hour

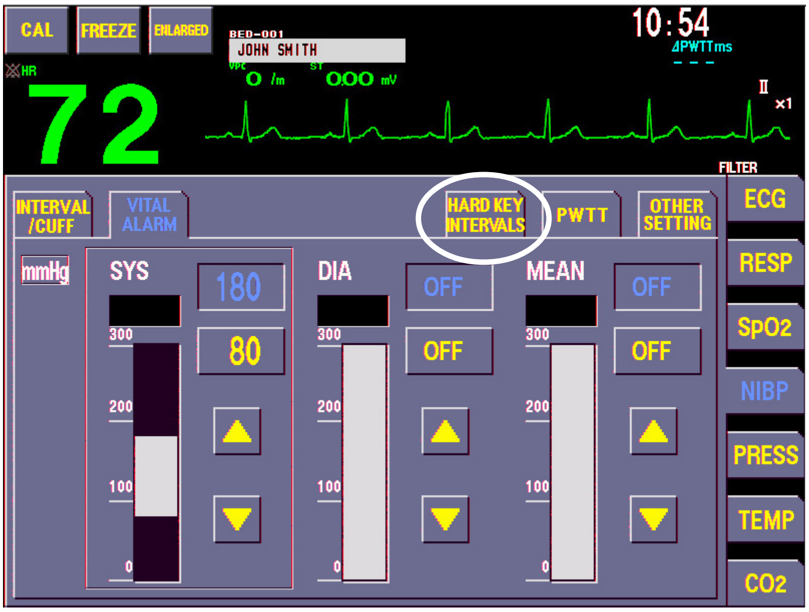
4. Select the desired interval from the MEASUREMENT INTERVAL box.

Selecting the Measurement Modes for the Mode Selection by the ◷ NIBP INTERVAL Key

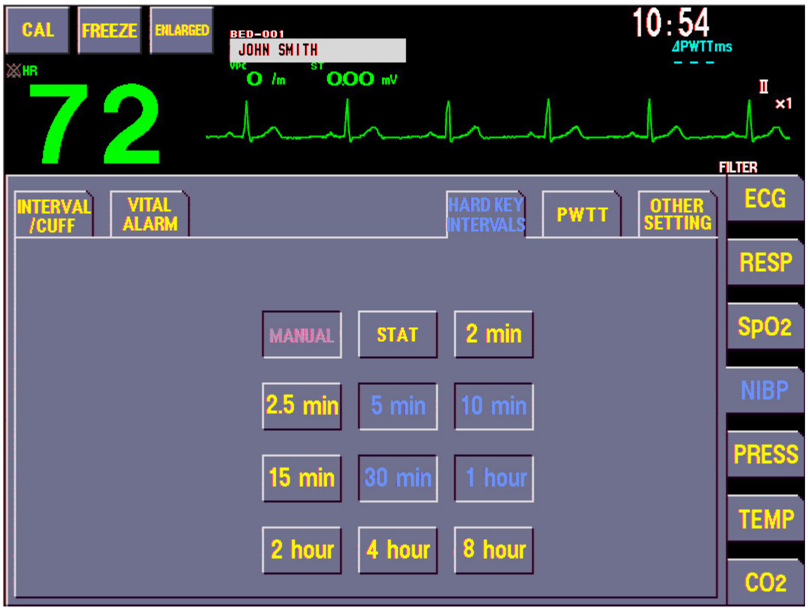


1. Press the MENU key on the front panel to display the MENU window.

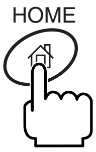
2. Touch the “NIBP” key. The NIBP window appears.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
10:54
ΔPWTTms
HR
72
VPC 0 /m
ST 0.00 mV
II ×1
FILTER
INTERVAL /CUFF
VITAL ALARM
HARD KEY INTERVALS
PWTT
OTHER SETTING
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
mmHg
SYS
180
80
DIA
OFF
OFF
MEAN
OFF
OFF
300
200
100
0

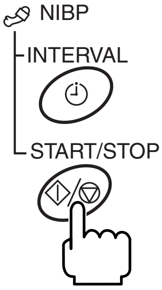
3. Touch the “HARD KEY INTERVALS” tab to display the HARD KEY INTERVALS window.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
10:54
ΔPWTTms
HR
72
VPC 0 /m
ST 0.00 mV
II ×1
FILTER
INTERVAL /CUFF
VITAL ALARM
HARD KEY INTERVALS
PWTT
OTHER SETTING
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
MANUAL
STAT
2 min
2.5 min
5 min
10 min
15 min
30 min
1 hour
2 hour
4 hour
8 hour

4. Select the measurement mode and intervals for the mode selection by the ◷ NIBP INTERVAL key on the front panel.



5. Press the HOME key on the front panel to return to the monitoring screen.



Measurement Modes

Manual Measurement

In Manual mode, a single NIBP measurement is performed when the ◇/▽ NIBP START/STOP key on the front panel is pressed.

STAT (Continuous) Measurement

WARNING

While performing STAT (continuous) measurements many times without a pause, periodically check the blood vessels and limb for adequate circulation.

In STAT mode, measurement is continuously repeated for 15 minutes after the ◇/▽ NIBP START/STOP key is pressed. There are two modes.

- Measure NIBP as many times as possible over a 15 minute period.
- Measure NIBP every minute for a 15 minute period.

Select the mode on NIBP STAT MODE on the SYSTEM SETUP screen. Refer to Section 3.

When the STAT (continuous) measurement for 15 minutes is completed, the measurement mode automatically changes to the Manual mode or Auto mode at 2, 2.5, 5, 10, 15 or 30 minute interval depending on the NIBP MODE AFTER STAT setting on the SYSTEM SETUP screen. The default setting is Manual mode. Refer to Section 3.

NOTE

When the "BYPASS" or "SUSPEND MONITORING" key is pressed, STAT measurement is suspended until the ◇/▽ NIBP START/STOP key is pressed.

Auto Measurement

WARNING

When performing long term measurements at intervals less than 2.5 minutes, periodically check the state of the patient, blood vessels and limb for adequate circulation.

In Auto mode, measurement is performed automatically at the preset time intervals. The time interval can be selected from the intervals preset on the HARD KEY INTERVALS window by pressing the ◷ NIBP INTERVAL key on the front panel. It can also be changed at MEASUREMENT INTERVAL on the NIBP window.

The actual measurement time is automatically timed from the next nearest selected interval. For example, if you start measurement at 9:02 with 5 min interval, the measurement will be performed at 9:05, 9:10, 9:15 and so on. If you start measurement at 10:35 with 60 min interval, the measurement will be performed at 11:00, 12:00, 13:00 and so on.

In the Auto mode, a single measurement can be performed by pressing the ◇/▽ NIBP START/STOP key on the front panel between auto measurements.

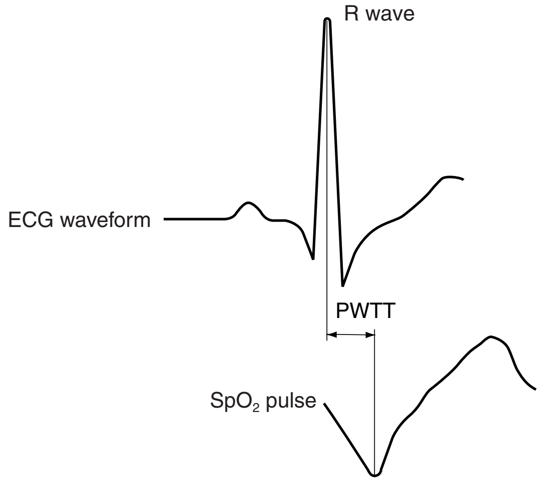
NOTE

- **The NIBP measurement time of the NIBP list on the LIST window is the time the measurement is completed.**
- **When the "BYPASS" or "SUSPEND MONITORING" key is pressed, Auto measurement is suspended until the ◇/▽ NIBP START/STOP key is pressed.**

Auto Measurement with PWTT

PWTT is only available on the BSM-2301/2351 monitor.

PWTT (pulse wave transit time) is a parameter which can indicate sudden change in blood pressure. PWTT is the interval between the R wave of the ECG and the onset of the SpO_2 pulse wave. In many cases, PWTT changes according to change in circulation. This PWTT change (delta PWTT) can be used to trigger NIBP measurement. When the delta PWTT exceeds a preset threshold, it triggers NIBP measurement. Therefore, PWTT can be used to monitor sudden critical changes in blood pressure which may go undetected by the usual periodic NIBP measurement.



CAUTION

- **Do not rely only on the PWTT to monitor blood pressure changes. When it is necessary to monitor critical blood pressure change, set the appropriate interval for NIBP measurement.**
- **When the delta PWTT threshold is too short for a patient, NIBP measurement may be performed too frequently. If this occurs, change the delta PWTT threshold to a longer time.**
- **The PWTT may be incorrect when there is too much arrhythmia or noise.**
- **Do not measure NIBP with PWTT on a neonate because circulation of a neonate changes rapidly.**

CAUTION continued

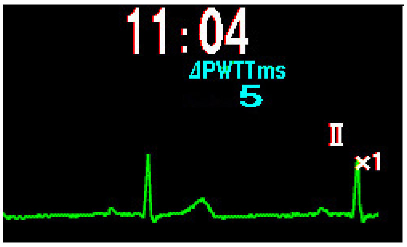
- **In the following cases, PWTT may trigger too many or no NIBP measurements. Check the patient condition. If necessary, change the delta PWTT threshold or set the PWTT to Off.**
  - **Rapid blood pressure change with vasoreflex due to vasoactive drugs, such as phenylephrine and nicardipine.**
  - **Unstable pulse wave due to poor peripheral circulation.**
  - **Too many arrhythmias.**
  - **Patient movement.**
  - **Noise on ECG due to ESU.**
  - **SpO_2 measurement on foot of a child.**

To use PWTT in automatic NIBP measurement, you must set the delta PWTT threshold on the PWTT window and the NIBP measurement mode to one of the intervals. To change settings for PWTT, refer to the "Changing the PWTT Settings" section. NIBP is measured at the selected interval and when the delta PWTT exceeds the preset threshold.

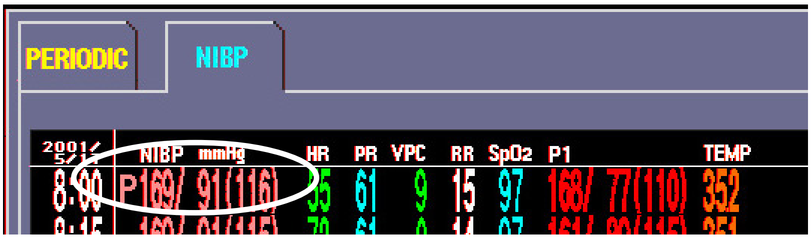
NOTE

- **NIBP measurement with PWTT can only be performed when the NIBP measurement mode is set to one of the intervals.**
- **NIBP measurement with PWTT is performed when ECG and SpO_2 are monitored. When ECG or SpO_2 is not monitored, delta PWTT appears blank on the monitoring screen.**
- **When using PWTT for NIBP measurement during operation, set arrhythmia analysis on the ECG window to on. If set to off, the PWTT may be incorrect due to ESU. Refer to Section 10.**
- **When the "BYPASS" or "SUSPEND MONITORING" key is pressed, Auto measurement with PWTT is suspended until the ⟐/⊜ NIBP START/STOP key is pressed.**

When the automatic measurement with PWTT is set to ON, delta PWTT is displayed in the upper right corner on the monitoring screen.



"P" is displayed beside the NIBP data on the LIST window when measured with PWTT.



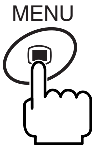
2001/ 5/1	NIBP mmHg	HR	PR	VPC	RR	SpO2	P1	TEMP
8:00	P169/ 91(116)	55	61	9	15	97	168/ 77(110)	35.2

Changing the NIBP Alarm Settings

CAUTION

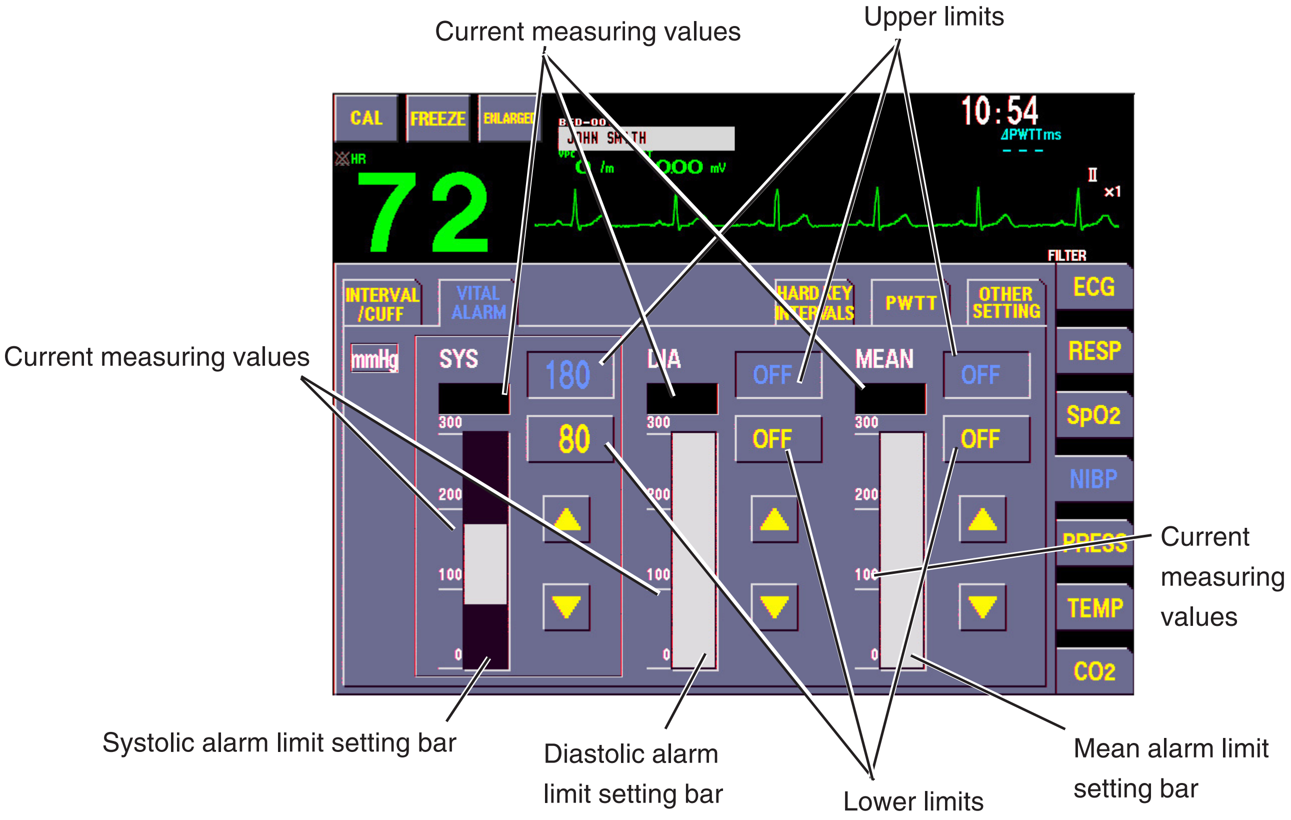
When the upper or lower alarm limit is turned off, there will be no NIBP upper or lower alarm for that limit.

You can set the upper and lower systolic, diastolic and mean NIBP alarm limits on the NIBP window. Other alarm items must be set on the VITAL ALARM window. You can set all alarms, including the upper and lower NIBP alarm limits, on the VITAL ALARM window (See Section 6).



1. Press the MENU key on the front panel to display the MENU window.

2. Touch the “NIBP” key. The NIBP VITAL ALARM window appears.

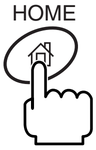

Current measuring values
Upper limits
CAL
FREEZE
ENLARGED
BED-00
JOHN SMITH
10:54
ΔPWTTms
HR
72
II
×1
FILTER
INTERVAL /CUFF
VITAL ALARM
HARD KEY INTERVALS
PWTT
OTHER SETTING
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
mmHg
SYS
180
80
300
200
100
0
DIA
OFF
OFF
MEAN
OFF
OFF
Current measuring values
Current measuring values
Systolic alarm limit setting bar
Diastolic alarm limit setting bar
Lower limits
Mean alarm limit setting bar

3. Touch the alarm setting bar.

4. Touch the upper limit box to set the upper limit or touch the lower limit box to set the lower limit.

5. Touch the desired level on the setting bar. Touch the ▲ or ▼ key to adjust the setting.

   If the upper limit is set to a value above the maximum or the lower limit is set to a value below the minimum, the alarm is set to OFF.



6. Press the HOME key on the front panel to return to the monitoring screen.

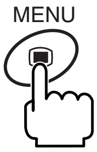
Changing the PWTT Settings

PWTT is only available on the BSM-2301/2351 monitor.

You can select automatic NIBP measurement with or without PWTT. When PWTT is set to on, you can also select the delta PWTT threshold for triggering NIBP measurement.

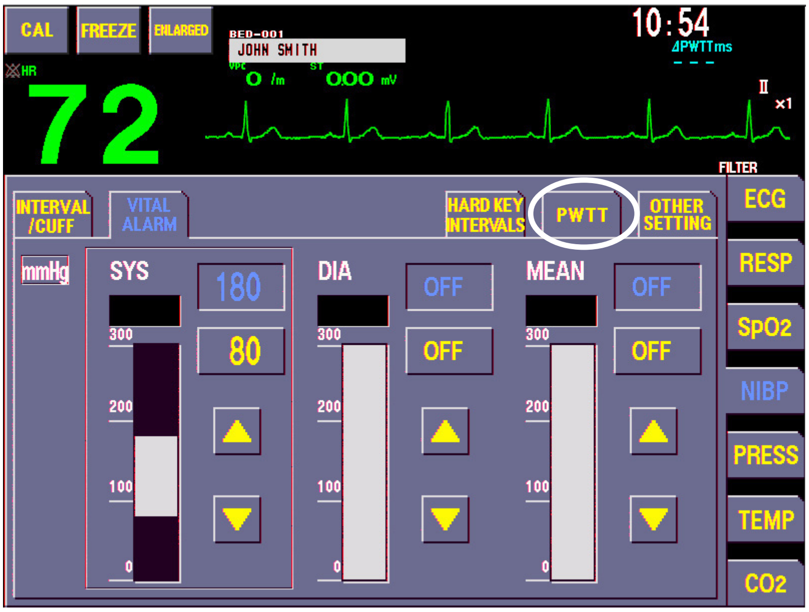
To trigger NIBP measurement with a smaller change in blood pressure, set the delta PWTT threshold to a shorter time.

If NIBP measurement is performed too frequently, set the delta PWTT threshold to a longer time.

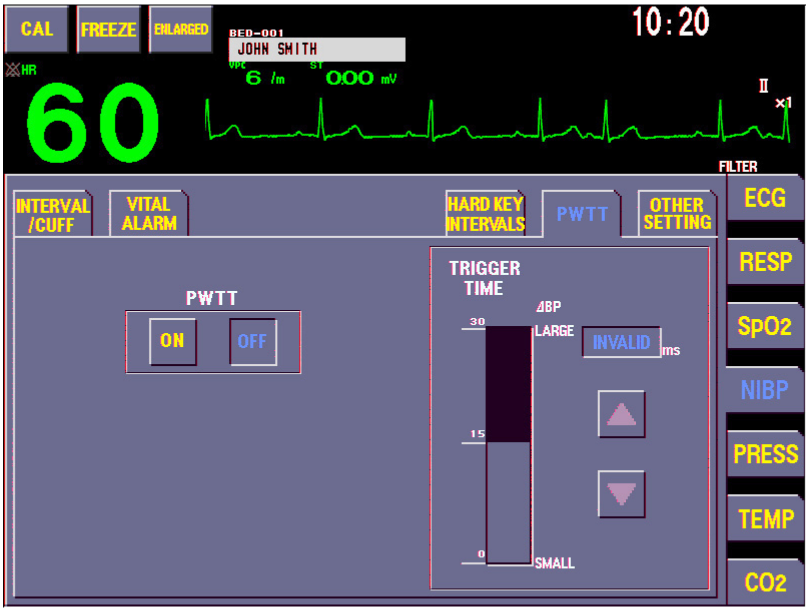


1. Press the MENU key on the front panel to display the MENU window.

2. Touch the “NIBP” key. The NIBP VITAL ALARM window appears.

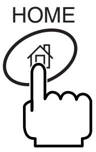

CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
10:54
ΔPWTTms
HR
72
VPC 0 /m
ST 0.00 mV
II ×1
FILTER
INTERVAL /CUFF
VITAL ALARM
HARD KEY INTERVALS
PWTT
OTHER SETTING
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
mmHg
SYS
180
80
DIA
OFF
OFF
MEAN
OFF
OFF
300
200
100
0

3. Touch the “PWTT” tab to display the PWTT window.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
10:20
HR
60
VPC 6 /m
ST 0.00 mV
II ×1
FILTER
INTERVAL /CUFF
VITAL ALARM
HARD KEY INTERVALS
PWTT
OTHER SETTING
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PWTT
ON
OFF
TRIGGER TIME
ΔBP
30
LARGE
INVALID
ms
15
0
SMALL

4. Select “ON” or “OFF” for PWTT.
   When set to “ON”, automatic NIBP measurement is performed with PWTT.

   When set to “ON”, select the delta PWTT threshold. Touch the desired level on the setting bar in the TRIGGER TIME box. Touch the ▲ or ▼ key to adjust the setting.



5. Press the HOME key on the front panel to return to the monitoring screen.

Measuring and Monitoring NIBP

When the preparation is done properly, you can start non-invasive blood pressure measurements and monitoring by pressing the ◇/⊽ NIBP START/STOP key on the front panel.

The monitor automatically identifies the type of cuff connected and sets the cuff inflation pressure.

WARNING

When performing long term measurements at intervals less than 2.5 minutes, periodically check the state of the patient, blood vessels and limb for adequate circulation.

CAUTION

- **When the "CONNECTOR OFF" message appears on the screen, connect the air hose to the socket properly. NIBP cannot be monitored and the alarm does not function properly while this message is displayed.**
- **When too much pressure is applied to the cuff, or the hose is folded or kinked, the "NIBP SAFETY CIRCUIT RUNNING" message appears on the screen and NIBP monitoring may be stopped. Remove the cause, wait for 40 seconds, check that the message disappears, then measure again.**

NOTE

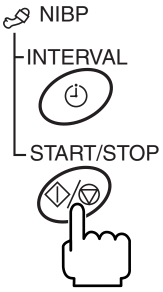
- **When measuring patients who are conscious, help the patient to relax. Measurement may not be accurate if the patient's arm is tense or if the patient talks.**
- **The data for measurement on the thigh tends to be higher than measurement on the arm.**
- **Do not apply pressure to the cuff or air hose. NIBP may not be measured correctly because of the noise or NIBP measurement may stop due to the NIBP safety circuit running.**

For error messages and monitoring problems, refer to Section 17.

Recommended Patient State

Keep the patient quiet and maintain the patient's arm in a relaxed position during NIBP measurement so that measurement can be done under optimal conditions.

Starting and Stopping NIBP Measurement



Starting and stopping can be controlled by the ◇/▽ NIBP START/STOP key on the front panel. Before starting measurement, select the measurement mode. Refer to the “Selecting the Measurement Mode and Interval” section.

NOTE

After NIBP measurement, the next measurement cannot start until the cuff pressure is less than 10 mmHg (2 mmHg in the NEONATE mode) for more than 3 seconds.

Manual Mode

To start the NIBP measurement in the Manual mode, press the ◇/▽ NIBP START/STOP key. The single measurement starts and automatically stops. To cancel it, press this key again during measurement.

STAT (Continuous) Mode

To start the NIBP measurement in the STAT mode, press the ◇/▽ NIBP START/STOP key. The measurement will be continuously repeated for 15 minutes. To stop (cancel) it within the 15 minutes, press this key again.

After completing the STAT measurement, the measurement mode changes to the mode set on “NIBP MODE AFTER STAT” on the SYSTEM SETUP screen. Refer to Section 3.

Auto Mode

The Auto mode works when one of the time intervals is selected.

The first NIBP measurement is performed when the ◇/▽ NIBP START/STOP key is pressed. The second measurement is performed when the current time (minutes) in the monitor reaches the nearest time interval selected. Refer to the “Selecting the Measurement Mode and Interval” section.

During auto measurement, the measurement mode is highlighted on the monitoring screen.

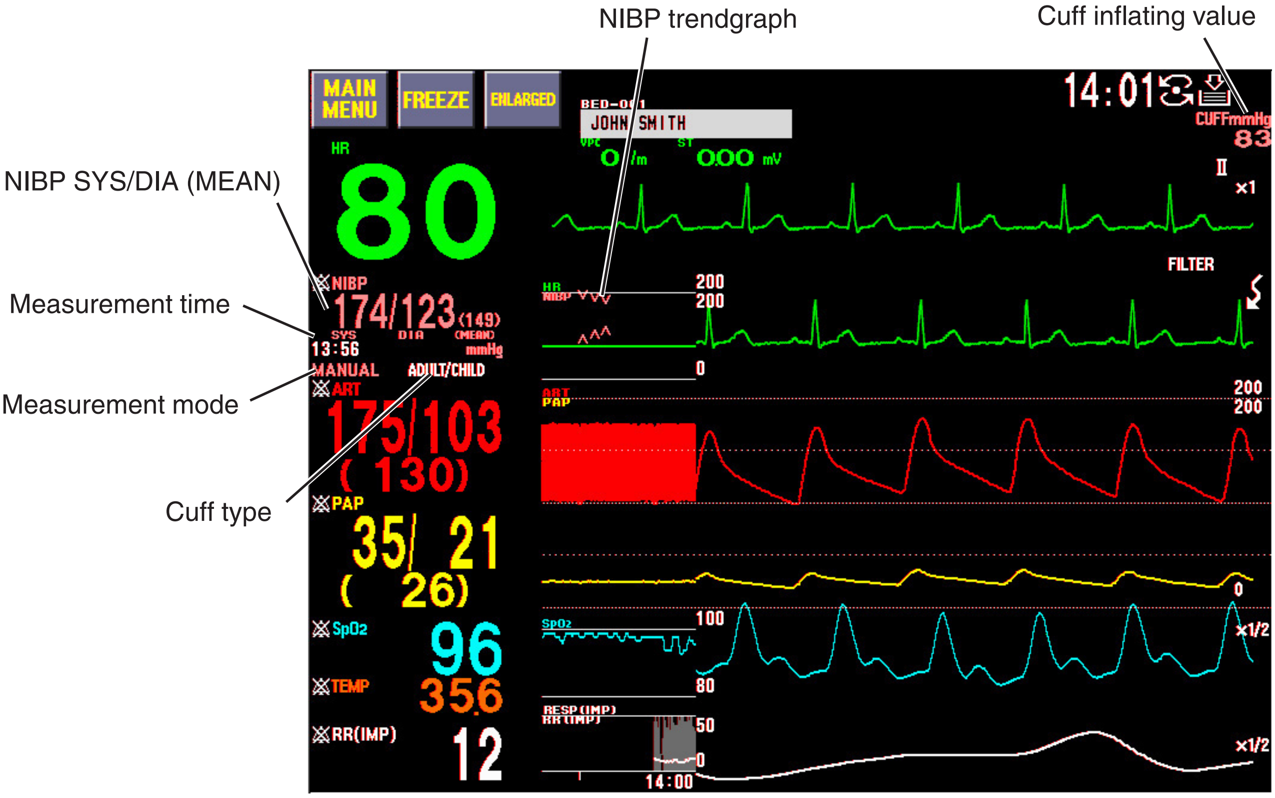
When PWTT is set to ON and trigger threshold is set on the PWTT window of the NIBP window, NIBP is automatically measured when the PWTT exceeds the threshold. Refer to the “Changing the PWTT Settings” section. PWTT is only available on the BSM-2301/2351 monitor.

To stop NIBP measurement in auto mode, change the mode to Manual.

To cancel one measurement, press the ◇/▽ NIBP START/STOP key during the measurement.

To perform a single measurement in this mode, press the◇/▽ NIBP START/STOP key once between auto measurements.

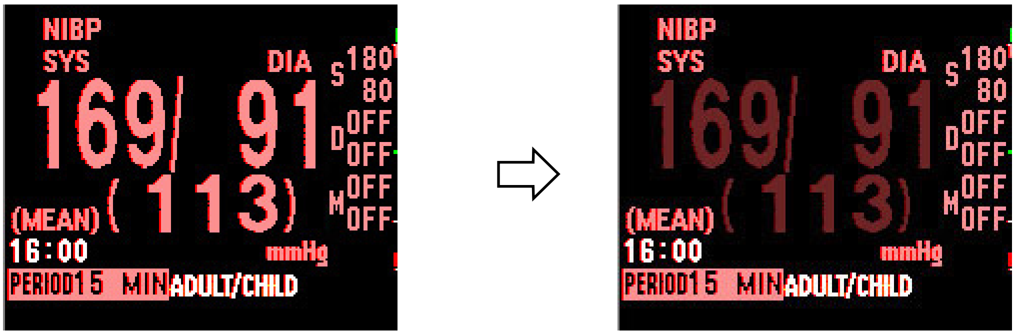
NIBP Information on the Monitoring Screen


NIBP trendgraph
Cuff inflating value
NIBP SYS/DIA (MEAN)
Measurement time
Measurement mode
Cuff type
MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
14:01
CUFFmmHg
83
HR
80
NIBP
174/123 (149)
SYS DIA (MEAN)
13:56
mmHg
MANUAL
ADULT/CHILD
ART
175/103
(130)
PAP
35/ 21
(26)
SpO2
96
TEMP
35.6
RR(IMP)
12
FILTER
200
0
100
80
50
14:00
×1
×1/2

Dimming and Hiding the NIBP Data

When the time set at OLD NIBP DATA AFTER on the SYSTEM SETUP screen elapses after the last measurement, the NIBP data on the monitoring screen is dimmed or hidden. Whether to dim or hide the old data can be selected at OLD NIBP DATA on the SYSTEM SETUP screen. Refer to Section 3.

(Example: dim old NIBP data)


NIBP
SYS
DIA
169/ 91
(MEAN) (113)
16:00
mmHg
PERIOD 15 MIN
ADULT/CHILD
S 180
80
D OFF
OFF
M OFF
OFF

Section 14 IBP Monitoring

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Preparing for Blood Pressure Monitoring 14.2
    Preparation Flowchart 14.2
    Selecting the Blood Pressure Measuring Device 14.2
        Blood Pressure Transducers 14.3
        IBP Connection Cords 14.4
    Installing the Blood Pressure Measuring Device 14.5
        Connecting Cables to the Monitor 14.5
        Assembling the Infusion Circuit 14.6
        Connecting the Dome to the Infusion Circuit 14.7
        Connecting the Blood Pressure Transducer to the Dome 14.8
    Adjusting Zero Balance 14.9
        Adjusting Zero Balance 14.9
Monitoring IBP 14.12
    IBP Information on the Monitoring Screen 14.12
Changing IBP Settings 14.13
    Changing the IBP Alarm Limits 14.13
    Changing the IBP Scale 14.14
    Changing the Sync Source 14.16
    Selecting Sync Sound Pitch 14.17
    Selecting the Mode for Calculating IBP 14.19
    Selecting the Data Display Mode 14.20
    Changing the IBP Waveform Display Mode 14.21
    Changing the Label 14.23
        Types of Labels 14.23
        Changing the Labels 14.23

General

On the BSM-2304 monitor, invasive blood pressure and intracranial pressure (ICP) are measured and monitored by connecting the blood pressure measuring device to the PRESS1 socket (P1) or multi-parameter socket (P2) on the monitor. Up to two channels can be monitored.

On the BSM-2301/2351 monitor, invasive blood pressure and intracranial pressure (ICP) are measured and monitored by connecting the blood pressure measuring device to the multi-parameter socket (P1) on the monitor. Only one channel is monitored.

CAUTION

Turn off the power of cell telephones, small wireless devices and other devices which produce strong electromagnetic interference. Otherwise, the waveforms and measurements are affected by such interference and the displayed data may be incorrect.

Preparing for Blood Pressure Monitoring

Preparation Flowchart

1. Select the blood pressure measuring device.

2. Install the blood pressure measuring device and connect the blood pressure transducer to the IBP connection cord, and IBP connection cord to the PRESS1 (on BSM-2304 only) or multi-parameter socket on the monitor. For details, refer to the instruction manual provided with the blood pressure transducer and measuring kit.

3. Insert the catheter into the patient.

4. Perform zero balance adjustment.

5. Change necessary settings.

6. Start measurements (Start monitoring).
   After zero balance adjustment, you can start IBP measurements and monitoring.

   For handling accessories after use, refer to Section 18.

Selecting the Blood Pressure Measuring Device

Select the appropriate blood pressure measuring device according to the purpose.

WARNING

All parts, except for transducers, must be non conductive. Otherwise, the discharged energy may cause electrical shock to the operator during defibrillation.

CAUTION

- **Check that there are no scratches on the catheter balloon before use.**
- **Do not reuse disposable parts and accessories.**

Blood Pressure Transducers

*1 These parts have not been checked for compliance with the MDD (Medical Device Directive). For EC member countries, Nihon Kohden recommends the use of parts that comply with MDD.

*2 These parts are discontinued.

Nihon Kohden and Becton Dickinson (Ohmeda) Reusable Blood Pressure Transducers

Pressure Transducer	IBP Connection Cord	Measuring Kit			Other Parts		Dome	Fixing Device
		Monitoring Kit	Extension Tube	Pressure Tubing	Flush Device	Criti Flo		Transducer Holder
TP-400T*1 (Nihon Kohden)	JP-910P	SCK-520*1	TY-015U*1*2 TY-030U*1*2 TY-060U*1*2 TY-090U*1*2 TY-120U*1*2 TY-150U*1*2	PT-06 PT-12 PT-24 PT-36 PT-48 PT-60	TY-421U*1*2	TA-4004 TA-4005*1	TY-410U*1 TA-1011*1 TA-1011D*1	ZY-101U*1
P-23XL1	JP-900P						TA-1015T TA-1010ND	ZY-101U*1 + adapter 2
P-10EZ1	JP-900P	SCK-512*1 SCK-560					TA-1017M TA-1019M TA-1017 TA-1018*1 TA-1019*1	TBG*2 TBG2 TMM UMM

Becton Dickinson (Ohmeda) Disposable Blood Pressure Transducers (DX Series)

Monitoring Kit DX Series	IBP Connection Cord	Other Parts	Fixing Device
DX-100*1	JP-900P	—	TBG*2 TBG2 TMM UMN
DX-200*1			
DX-300*1			
DX-312*1			
DX-360*1			
DX-360R*1			
DX-360TT*1			
DX-360SD*1		Safe needle TA-BPN + arterial blood sampler QS-90	
SCKD-5005*1		—	

Baxter Disposable Blood Pressure Transducers (TruWave)

Baxter blood pressure transducers are available direct from Baxter Healthcare Corporation (www.baxter.com) or their suppliers.

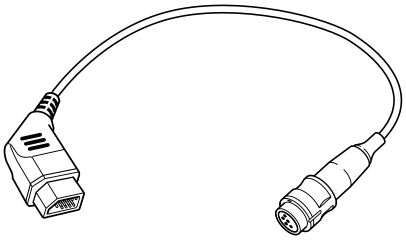
Monitor Kit	IBP Connection Cord	Fixing Device
MK12030US(TW)*1	JP-920P	59-UH4 59-DTS-C
MK12030UW(TW)*1		
MK12030UT(TW)*1		
MP-5100(TW)*1		
MP-5200(TW)*1		

IBP Connection Cords

The IBP connection cord connector has a memory chip for saving site label and zero balance adjustment values. Attach the blood pressure site label of the saved site.

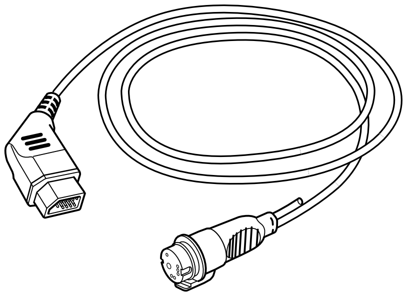
JP-910P

For Nihon Kohden and Becton Dickinson (Ohmeda) reusable blood pressure transducers



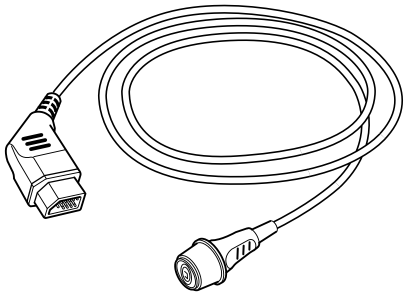
JP-900P

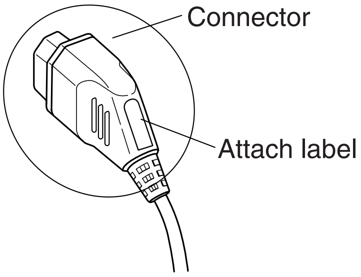
For Becton Dickinson (Ohmeda) reusable and DX series blood pressure transducers



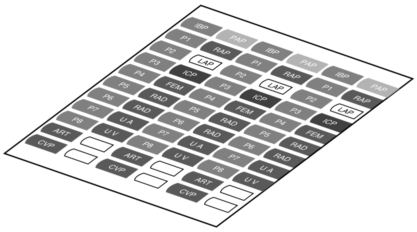
JP-920P

For Baxter disposable blood pressure transducers





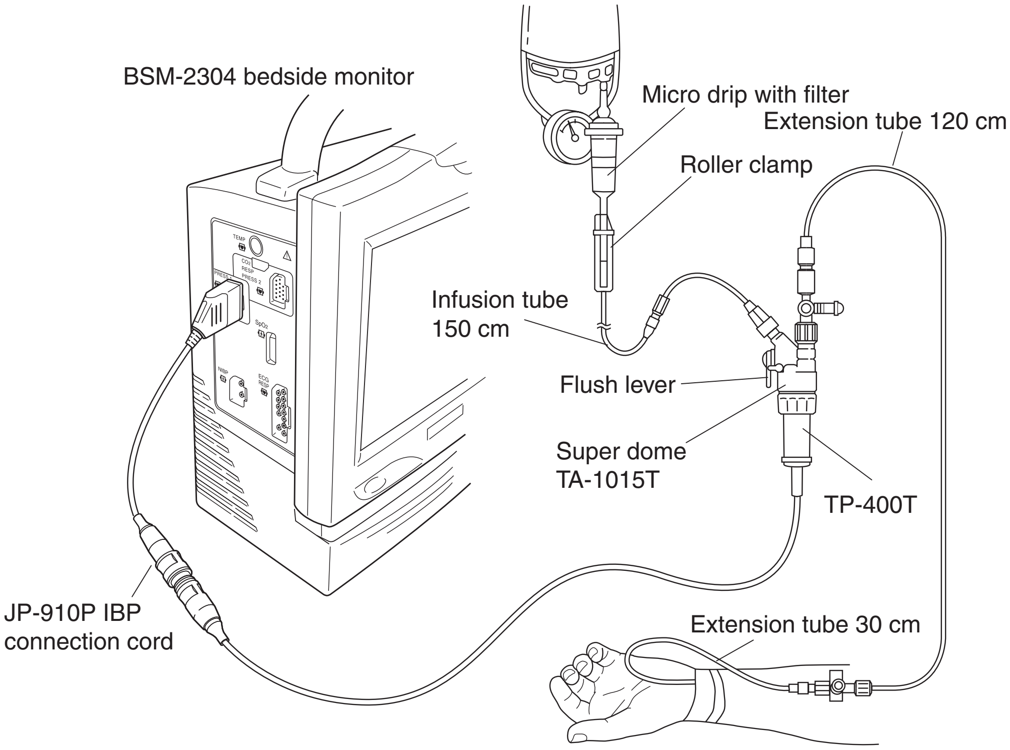
Blood pressure site label



Installing the Blood Pressure Measuring Device

The following describes installing the TP-400T blood pressure transducer and SCK-520 monitoring kit. When using other blood pressure transducers and measuring kits, refer to the respective instruction manuals.

Typical Configuration Example

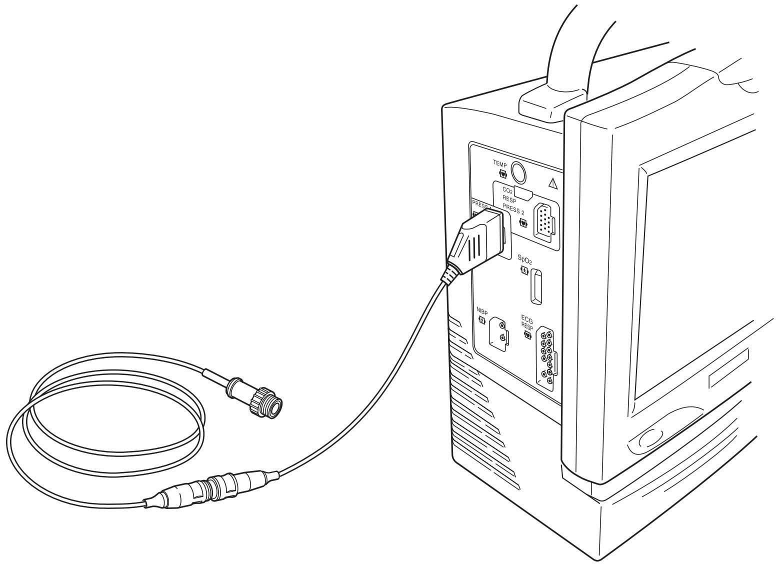

BSM-2304 bedside monitor
Micro drip with filter
Extension tube 120 cm
Roller clamp
Infusion tube
150 cm
Flush lever
Super dome
TA-1015T
TP-400T
JP-910P IBP
connection cord
Extension tube 30 cm

Connecting Cables to the Monitor

1. Connect the blood pressure transducer to the IBP connection cord.

2. Connect the IBP connection cord to the PRESS1 socket (on BSM-2304 only) or multi-parameter socket on the monitor.

   On the BSM-2304 monitor, the IBP waveform of the PRESS1 socket appears on the first channel (P1) and the IBP waveform of the multi-parameter socket appears on the second channel (P2) on the monitoring screen.



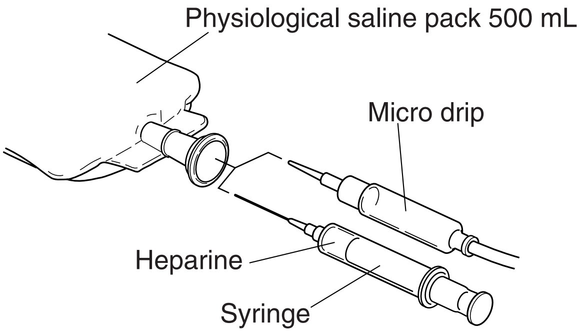
Assembling the Infusion Circuit

WARNING

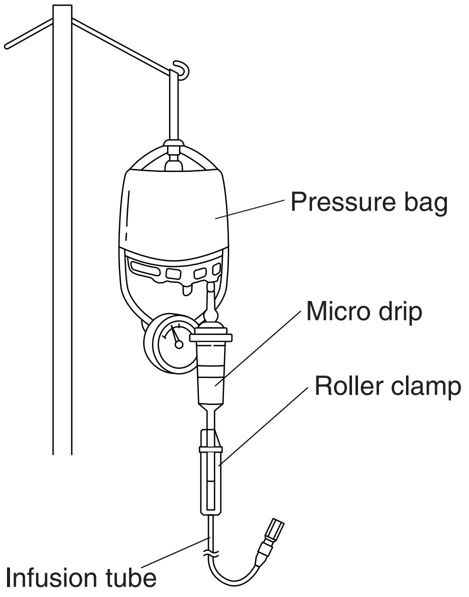
- **Do not use an expired saline pack.**
- **Do not use a blood pressure monitoring kit from a torn package.**
- **Vent out any air inside the saline pack by squeezing the saline pack. Otherwise, the air will cause an error in the blood pressure data and can enter the patient's blood vessel.**

NOTE

- **To add heparin, insert the syringe needle straight into the rubber cap of the pack. If you make another needle hole in the rubber cap, it will leak even though the hole is quite small.**
- **Use the mixed solution as soon as possible without storing or saving it.**



1. Inject 1000 units of heparin into 500 mL sterilized physiological saline solution and mix well.
2. Close the roller clamp and insert the needle at the tip of the micro-drip into the hole on the physiological saline pack through which heparin was injected.



3. Check that the roller clamp is closed. Press the micro-drip lightly several times, to fill the solution in the micro-drip to about 1/3 full.
4. Open the roller clamp and completely fill the infusion tube with saline solution.

NOTE

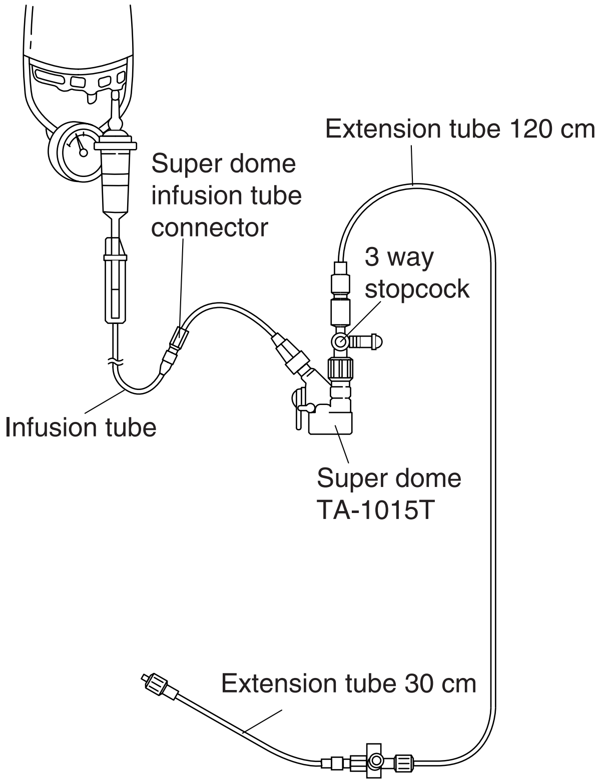
Fill completely with saline solution so that there are no air bubbles in the infusion tube.

5. Place the saline pack in the pressure bag and hang the pressure bag on the stand.
6. Eliminate air bubbles in the tube completely. With the saline solution overflowing from the tip of the infusion tube, close the roller clamp.

Connecting the Dome to the Infusion Circuit

CAUTION

- **Do not leave bubbles in the flushed dome and extension tube because they will distort the blood pressure waveform.**
- **Carefully flush the tube joints because bubbles tend to remain in the joints.**
- **Do not pressurize the pressure bag until bubbles are removed from both the dome and the extension tubes.**

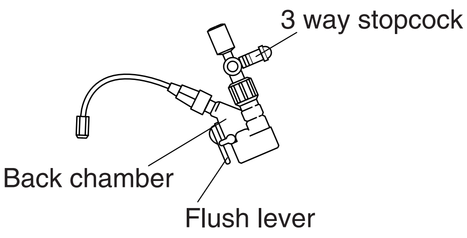

Extension tube 120 cm
Super dome infusion tube connector
3 way stopcock
Infusion tube
Super dome TA-1015T
Extension tube 30 cm

1. Connect the infusion tube to the super dome infusion tube connector.

NOTE

Make sure that air bubbles do not enter the infusion tube when connecting.

2. Open the 3-way stopcock and expose the extension tube to air.


3 way stopcock
Back chamber
Flush lever

3. Tilt the super dome as shown in the figure.

4. Open the roller clamp, and push the flush lever gently to fill the back chamber of the super dome with saline solution.

NOTE

When filling the back chamber with saline solution by applying pressure to the pressure bag, do not press the flush lever because this will produce air bubbles in the back chamber.

5. After completely filling the back chamber with saline solution, press the flush lever again so that the saline solution flows into the super dome and extension tube. Completely eliminate air bubbles in all circuits with the fluid overflowing from the tip of the extension tube.

NOTE

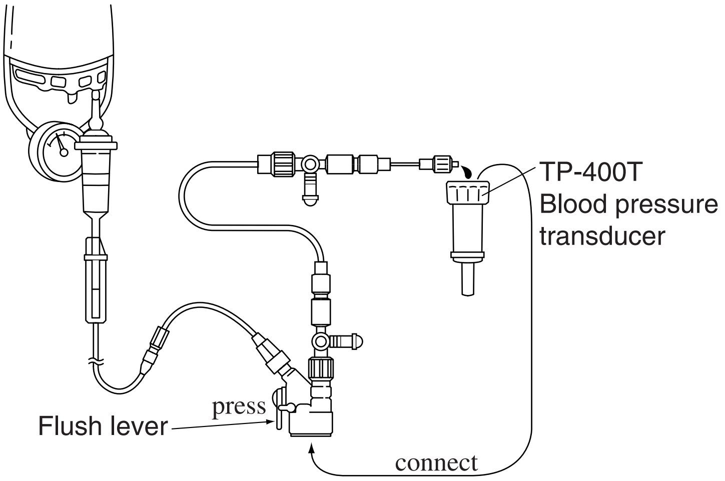
Completely eliminate the air bubbles in all circuits.

- If the air bubbles cannot be eliminated:
  1) Remove the infusion tube from the super dome.
  2) While pressing the flush lever, shake the super dome and remove all saline solution from inside the super dome completely.
  3) Repeat the procedure from step 6 in the “Assembling the Infusion Circuit” section.

6. Pressurize the pressure bag to 300 mmHg.
At this pressure, the super dome has a flow rate of 2 to 4 mL/hr.
Check that the solution level of the micro-drip is not too high when pressurized.

If too high, remove the infusion tube from the super dome, and repeat the procedure from step 2 in the “Assembling the Infusion Circuit” section.

Connecting the Blood Pressure Transducer to the Dome



1. Press the flush lever so that the saline solution drips from the tip of the extension tube and saturates the membrane of the blood pressure transducer.

2. Connect the blood pressure transducer to the super dome so that the membrane of the blood pressure transducer and dome align.

3. Check all connections.

NOTE

After connecting, check that the blood pressure transducer and dome membrane are completely sealed. Measurements cannot be performed correctly if there are air bubbles or spaces between them.

Adjusting Zero Balance

Adjust zero balance in the following cases. Zero balance adjustment is important for accurate IBP measurement.

- Before starting measurements.
- When the patient moved so that the height of the heart changed.
- When the height of the blood pressure transducer changes.
- When changes in the measured value are expected due to measurements over a long period of time or due to changes in the ambient temperature (check the pressure when exposed to air).
- When the IBP connection cord is disconnected and connected again to the multi-parameter socket on the monitor.

There are two ways for adjusting zero balance.

- **Assigning PRESS ALL ZERO to a Function Key**

  Assign PRESS ALL ZERO to a function key at the upper left of the screen. Refer to “Assigning a Function to the Function Key” in Section 4.

  Touch the PRESS ALL ZERO key at the upper left corner of the screen to perform zero balance.

- **From the PRESS window**

  On BSM-2304

  To adjust zero balance for the line connected to the PRESS1 socket, touch the ZERO CAL key in the ZERO CALIBRATION box on the P1 SCALE/ZERO CAL window of the PRESS window.

  To adjust zero balance for the line connected to the multi-parameter socket, touch the ZERO CAL key in the ZERO CALIBRATION box on the P2 SCALE/ZERO CAL window of the PRESS window.

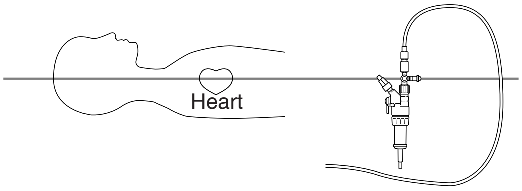
  On BSM-2301/2351

  To adjust zero balance for the line connected to the multi-parameter socket, touch the ZERO CAL key in the ZERO CALIBRATION box on the P1 SCALE/ZERO CAL window of the PRESS window.

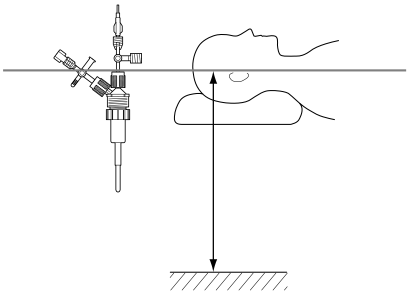
Adjusting Zero Balance

1. Move the dome up or down to position.

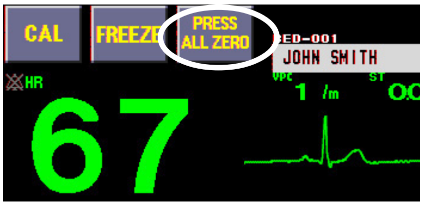
   The 3-way stopcock on the dome to the level of the right atrium of the patient and expose the air release opening of the 3-way stopcock to air.

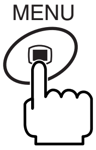


When measuring the intracranial pressure, adjust the 3-way stopcock of the catheter to the level of the ventricle and expose the air release opening of the 3-way stopcock to air.

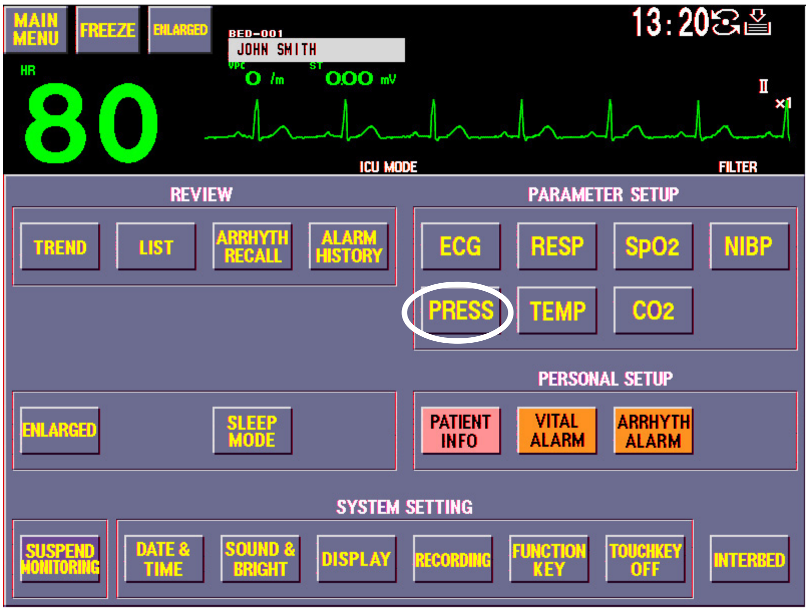


2. Perform zero balance adjustment.
   - Using the Function Key
     1) Check that PRESS ALL ZERO is assigned to one of the function keys at the upper left corner of the screen. Refer to "Assigning a Function to the Function Keys" in Section 4.
     2) Press the PRESS ALL ZERO key at the upper left corner of the screen.
     3) When the "ZEROING COMPLETE" message is displayed on the screen, zero balance adjustment is completed.

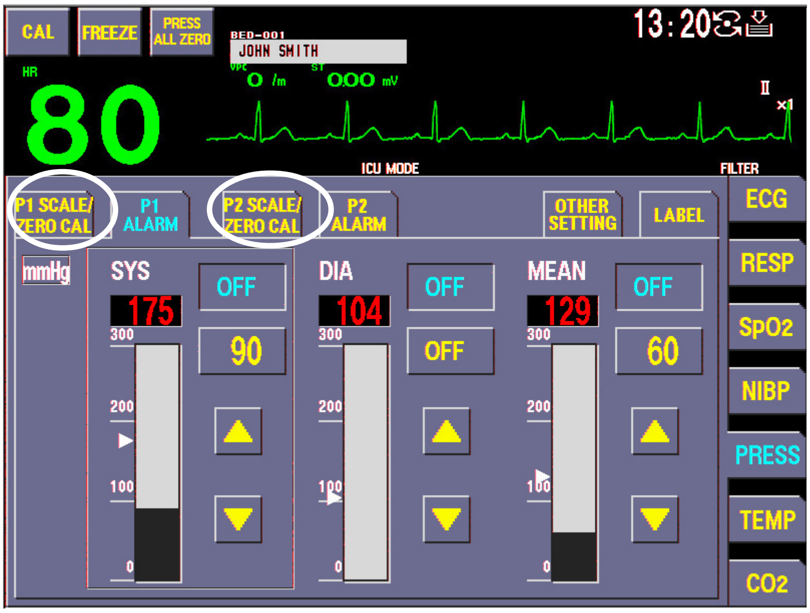

CAL
FREEZE
PRESS ALL ZERO
BED-001
JOHN SMITH
HR
67
VPC
1 /m
ST
0.0



   - From the PRESS window
     1) Press the MENU key on the front panel to display the MENU window.

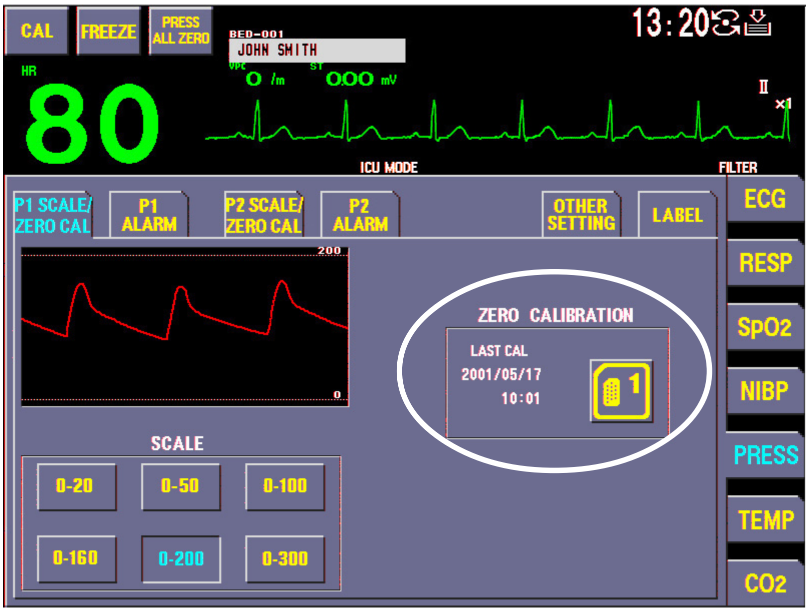

MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC
0 /m
ST
0.00 mV
II
×1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

     2) Touch the "PRESS" key. The PRESS P1 ALARM window appears.


CAL
FREEZE
PRESS ALL ZERO
BED-001
JOHN SMITH
13:20
HR
80
VPC 0 /m
ST 0.00 mV
II
×1
ICU MODE
FILTER
P1 SCALE/ ZERO CAL
P1 ALARM
P2 SCALE/ ZERO CAL
P2 ALARM
OTHER SETTING
LABEL
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
mmHg
SYS
175
OFF
90
DIA
104
OFF
OFF
MEAN
129
OFF
60
300
200
100
0

3) On the BSM-2304 monitor, to zero balance the line connected to the PRESS1 socket, touch the P1 SCALE/ZERO CAL tab to display the P1 SCALE/ZERO CAL window. To zero balance the line connected to the multi-parameter socket, touch the P2 SCALE/ZERO CAL tab to display the P2 SCALE/ZERO CAL window.

On the BSM-2301/2351 monitor, touch the P1 SCALE/ZERO CAL tab to display the P1 SCALE/ZERO CAL window.


CAL
FREEZE
PRESS ALL ZERO
BED-001
JOHN SMITH
13:20
HR
80
VPC 0 /m
ST 0.00 mV
II
×1
ICU MODE
FILTER
P1 SCALE/ ZERO CAL
P1 ALARM
P2 SCALE/ ZERO CAL
P2 ALARM
OTHER SETTING
LABEL
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
200
0
ZERO CALIBRATION
LAST CAL
2001/05/17
10:01
1
SCALE
0-20
0-50
0-100
0-160
0-200
0-300

4) Touch the multi-parameter key in the ZERO CALIBRATION box.

5) When the “ZEROING COMPLETE” message is displayed, zero balance adjustment is completed.

3. Close the 3-way stopcock.

After adjusting zero balance and closing the 3-way stopcock, IBP is ready to be measured. The IBP value and blood pressure waveform appear on the screen.

Monitoring IBP

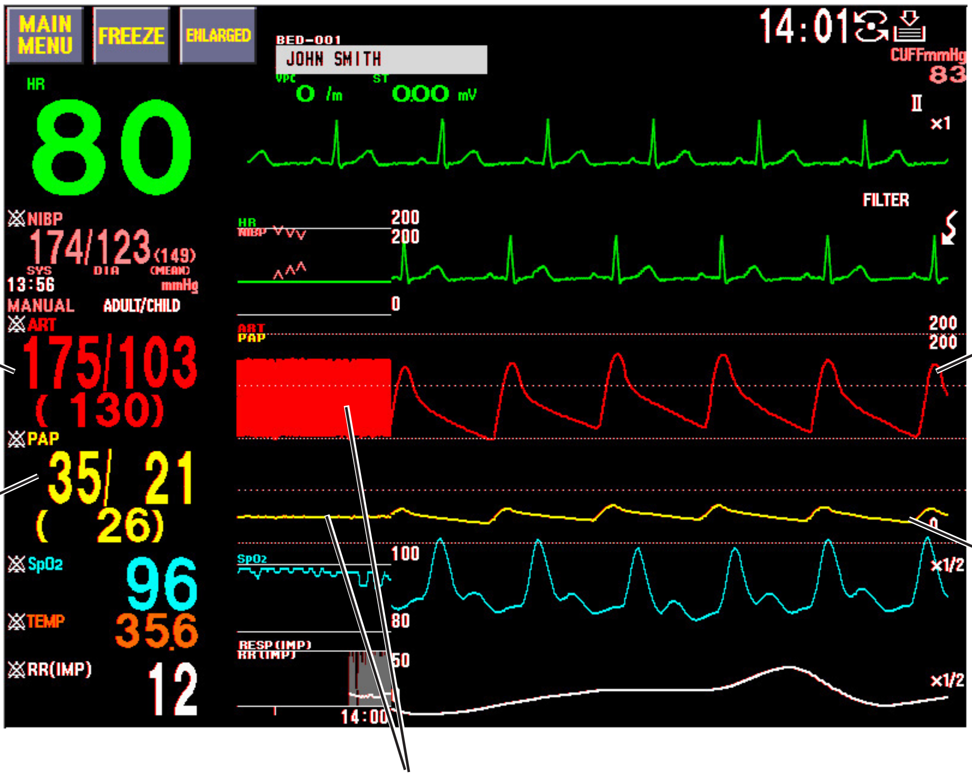
When the 3-way stopcock is closed after zero balance, you can start IBP monitoring.

CAUTION

Turn off the power of cellular telephones, small wireless devices and other devices which produce strong electromagnetic interference. Otherwise, the waveforms and measurements are affected by such interference and the displayed data may be incorrect.

For error messages and monitoring problems, refer to Section 17.

IBP Information on the Monitoring Screen


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
14:01
CUFFmmHg
83
HR
80
VPC 0 /m
ST 0.00 mV
II
×1
FILTER
NIBP
174/123 (149)
SYS DIA (MEAN)
mmHg
13:56
MANUAL
ADULT/CHILD
HR
NIBP
200
200
0
ART
175/103
(130)
ART
PAP
200
200
PAP
35/ 21
(26)
0
SpO2
96
100
80
×1/2
TEMP
35.6
RR(IMP)
12
RESP(IMP)
RR(IMP)
50
14:00
×1/2

IBP values of the line connected to the PRESS1 socket (Not available on BSM-2301/2351)

IBP values of the line connected to the multi-parameter socket

IBP waveform of the line connected to the PRESS1 socket (Not available on BSM-2301/2351)

IBP waveform of the line connected to the multi-parameter socket

IBP trendgraphs

Changing IBP Settings

NOTE

When using the multi-parameter socket for monitoring IBP, the IBP connection cord must be connected to the multi-parameter socket to change settings for IBP.

Change settings on the PRESS window. The following settings can be changed for monitoring IBP.

- IBP alarm limits
- Scale
- Sync source
- Sync sound pitch
- IBP calculation mode
- Data display mode
- Waveform display mode
- Label

The following items can be set on the SYSTEM SETUP screen. Refer to Section 3.

- Noise filter
- Unit (mmHg or kPa)

Changing the IBP Alarm Limits

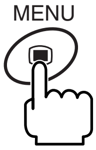
CAUTION

When the upper or lower alarm limit is turned off, there will be no IBP upper or lower alarm for that limit.

You can set the upper and lower IBP alarm limits on this window. Other alarm items must be set on the VITAL ALARM window. You can set all alarms, including the upper and lower BP alarm limits, on the VITAL ALARM window (See Section 6).

On the BSM-2304 monitor, set alarm on the P1 ALARM window for the line connected to the PRESS1 socket and on the P2 ALARM window for the line connected to the multi-parameter socket.

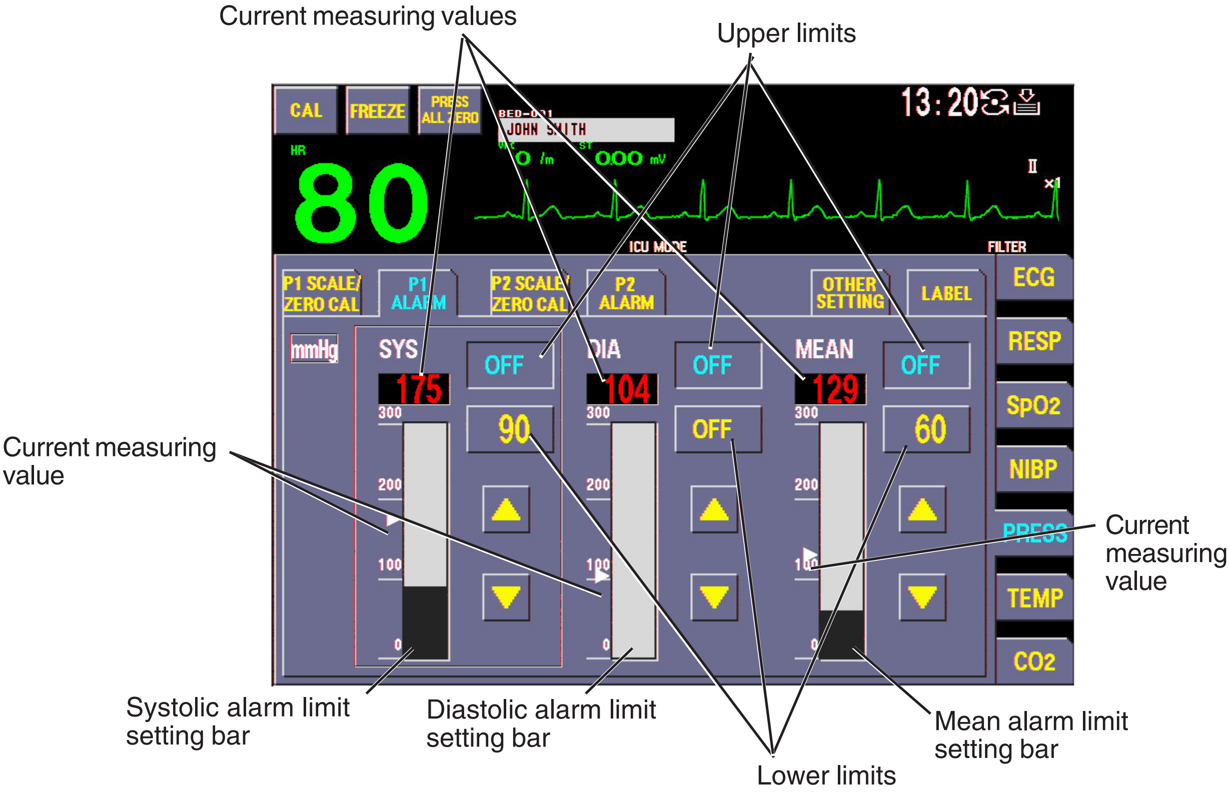
On the BSM-2301/2351 monitor, set alarm on the P1 ALARM window for the line connected to the multi-parameter socket.



1. Press the MENU key on the front panel to display the MENU window.

2. Touch the “PRESS” key. The PRESS P1 ALARM window appears.

   To change P2 alarm settings, touch the P2 ALARM tab to display the P2 ALARM window.

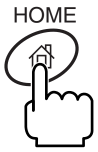

Current measuring values
Upper limits
CAL
FREEZE
PRESS ALL ZERO
BED-001
JOHN SMITH
13:20
HR
80
ICU MODE
FILTER
P1 SCALE/ ZERO CAL
P1 ALARM
P2 SCALE/ ZERO CAL
P2 ALARM
OTHER SETTING
LABEL
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
mmHg
SYS
175
OFF
90
DIA
104
OFF
OFF
MEAN
129
OFF
60
300
200
100
0
Current measuring value
Current measuring value
Systolic alarm limit setting bar
Diastolic alarm limit setting bar
Lower limits
Mean alarm limit setting bar

3. Touch the SYS, DIA or MEAN alarm setting bar to change the setting.

4. Touch the upper limit box to set the upper limit or touch the lower limit box to set the lower limit.

5. Touch the desired level on the setting bar. Touch the ▲ or ▼ key to adjust the setting.

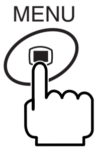
   If the upper limit is set to a value above the maximum or the lower limit is set to a value below the minimum, the alarm is set to OFF.



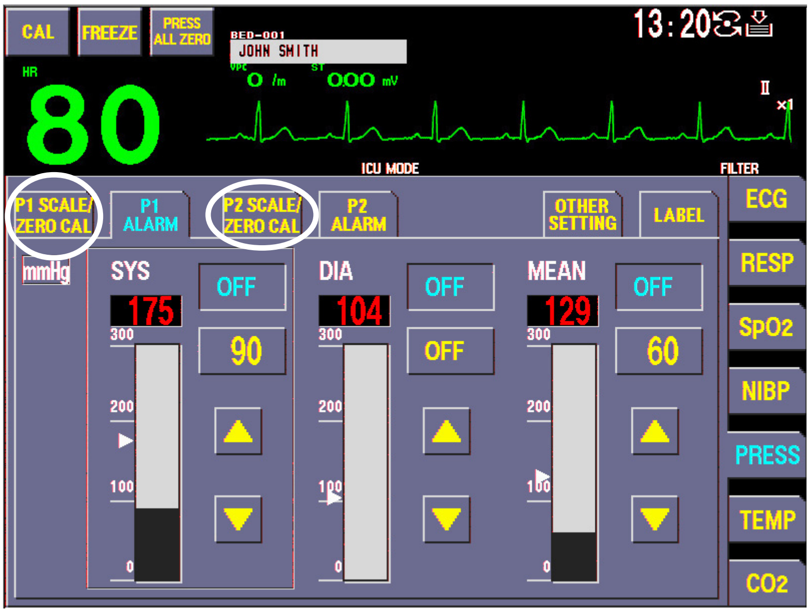
6. Press the HOME key on the front panel to return to the monitoring screen.

Changing the IBP Scale

1. Press the MENU key on the front panel to display the MENU window.

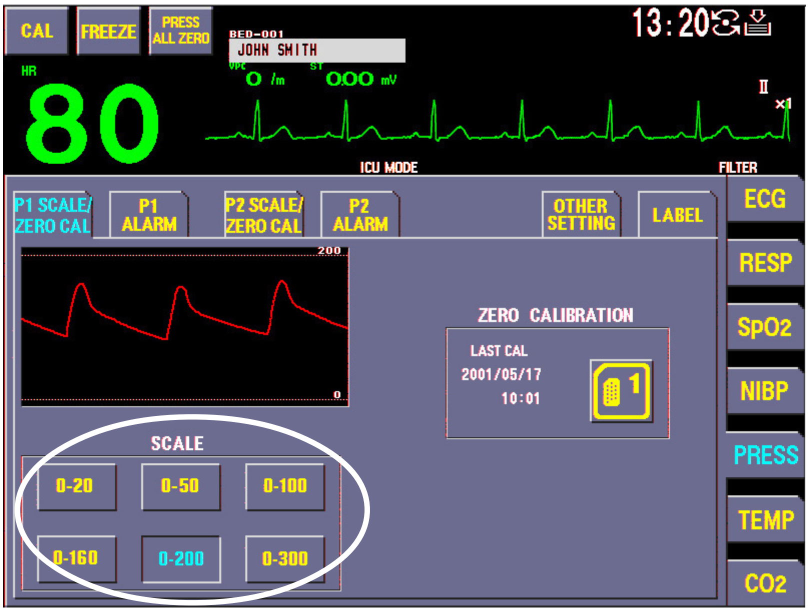


2. Touch the “PRESS” key. The PRESS P1 ALARM window appears.

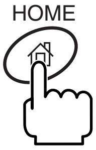

CAL
FREEZE
PRESS ALL ZERO
BED-001
JOHN SMITH
13:20
HR
80
VPC 0 /m
ST 0.00 mV
II
×1
ICU MODE
FILTER
P1 SCALE/ ZERO CAL
P1 ALARM
P2 SCALE/ ZERO CAL
P2 ALARM
OTHER SETTING
LABEL
mmHg
SYS
175
OFF
90
DIA
104
OFF
OFF
MEAN
129
OFF
60
300
200
100
0
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2

3. On the BSM-2304 monitor, touch the “P1 SCALE/ZERO CAL” tab to display the P1 SCALE/ZERO CAL window to change the scale for the PRESS1 socket, and touch the “P2 SCALE/ZERO CAL” tab to display the P2 SCALE/ZERO CAL window to change the scale for the multi-parameter socket.

On the BSM-2301/2351 monitor, touch the “P1 SCALE/ZERO CAL” tab to display the P1 SCALE/ZERO CAL window to change the scale for the multi-parameter socket.


CAL
FREEZE
PRESS ALL ZERO
BED-001
JOHN SMITH
13:20
HR
80
VPC 0 /m
ST 0.00 mV
II
×1
ICU MODE
FILTER
P1 SCALE/ ZERO CAL
P1 ALARM
P2 SCALE/ ZERO CAL
P2 ALARM
OTHER SETTING
LABEL
200
0
ZERO CALIBRATION
LAST CAL
2001/05/17
10:01
1
SCALE
0-20
0-50
0-100
0-160
0-200
0-300
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2

4. Select the scale by touching the desired scale key in the SCALE box.



5. Press the HOME key on the front panel to return to the monitoring screen.

Changing the Sync Source

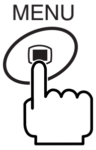
You can select ECG, SpO$_2$ pulse (SpO$_2$) or arterial blood pressure pulse (P1) as the sync source.

NOTE

- **When pulse wave and pressure waveform are irregular because of an IABP, select ECG.**
- **When heart rate is unstable because of an electrosurgical unit, select SpO$_2$ or P1.**
- **When the connection cord of SpO$_2$ or IBP is disconnected from the monitor and alarm occurs when the sync source is set to SpO$_2$ or P1, the sync source changes to ECG when the alarm is silenced by pressing the SILENCE ALARMS key. The sync source returns to SpO$_2$ or P1 when the SpO$_2$ or IBP is monitored again. In this case, adjust balance for IBP.**
- **When the sensor is detached from the patient and alarm occurs, and the sync source is set to SpO$_2$ or P1, the sync source does not change to ECG when the alarm is silenced and PR is displayed “- - - “.**
- **On BSM-2304, to use P1 as the sync source, the IBP must be monitored by the PRESS1 socket.**

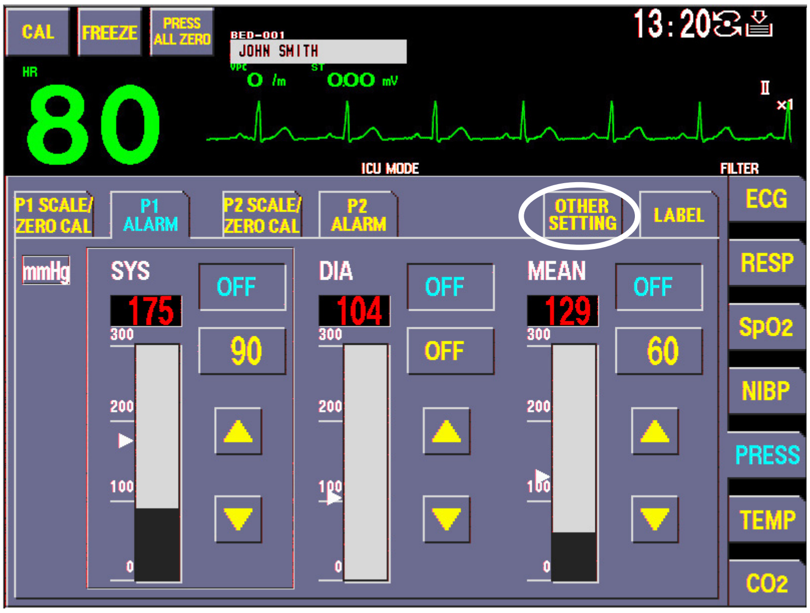
When the sync source is set to ECG and ECG is not measured, there is no sync sound.

When SpO$_2$ or P1 is selected, the pulse rate is displayed instead of the heart rate on the screen.

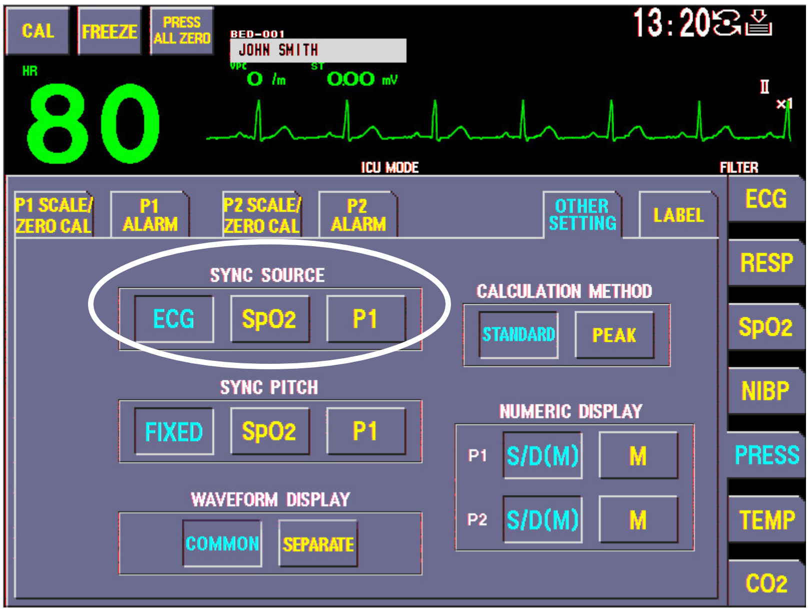


1. Press the MENU key on the front panel to display the MENU window.

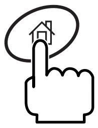
2. Touch the “PRESS” key. The PRESS P1 ALARM window appears.


CAL
FREEZE
PRESS ALL ZERO
BED-001
JOHN SMITH
13:20
HR
80
VPC
0 /m
ST
0.00 mV
II
×1
ICU MODE
FILTER
P1 SCALE/ ZERO CAL
P1 ALARM
P2 SCALE/ ZERO CAL
P2 ALARM
OTHER SETTING
LABEL
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
mmHg
SYS
175
OFF
90
DIA
104
OFF
OFF
MEAN
129
OFF
60
300
200
100
0

3. Touch the “OTHER SETTING” tab to display the OTHER SETTING window.


CAL
FREEZE
PRESS ALL ZERO
BED-001
JOHN SMITH
13:20
HR
80
VPC 0 /m
ST 0.00 mV
II
×1
ICU MODE
FILTER
P1 SCALE/ ZERO CAL
P1 ALARM
P2 SCALE/ ZERO CAL
P2 ALARM
OTHER SETTING
LABEL
SYNC SOURCE
ECG
SpO2
P1
CALCULATION METHOD
STANDARD
PEAK
SYNC PITCH
FIXED
SpO2
P1
NUMERIC DISPLAY
P1 S/D(M) M
P2 S/D(M) M
WAVEFORM DISPLAY
COMMON
SEPARATE
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2

4. Touch the “ECG”, “SpO_2” or “P1” key in the SYNC SOURCE box to select the sync source.



5. Press the HOME key on the front panel to return to the monitoring screen.

Selecting Sync Sound Pitch

The sync sound can be variable pitch or fixed pitch pips. The fixed pitch is high pitch as the default, but medium or low pitch can also be set. See Section 3. When you select variable pitch, the pitch of the sync sound changes according to SpO_2 value or systolic BP value of the arterial blood pressure.

When the variable pitch with SpO_2 value is selected, the pitch of the sync sound changes as follows.

SpO2 Value	Pitch of Sync Sound
100 to 81%	High to low pitch, in 1% steps
Less than 81%	Low pitch

When the variable pitch with systolic BP value is selected, the pitch of the sync sound changes as follows.

Systolic BP Value	Pitch of Sync Sound
Higher than 120 mmHg	High pitch
120 to 20 mmHg	High to low pitch, in 5 mmHg steps
Less than 20 mmHg	Low pitch

When the sync source is set to SpO_2 and the “CHECK PROBE”, “DETECTING PULSE” or “CHECK SENSOR” message appears on the screen, the sync sound stops.

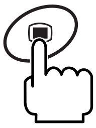
When the sync source is set to ECG or P1, sync pitch is set to P1 and the “CHECK SENSOR” message appears on the screen, the low pitch is selected automatically.

When the SpO_2 connection cord or IBP connection cord is disconnected from the monitor, ECG is automatically selected as the sync source.

NOTE

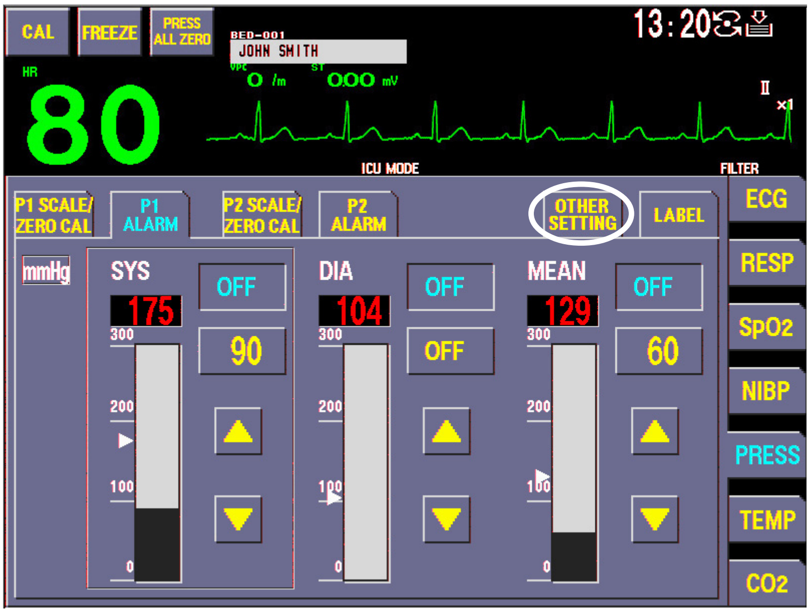
On BSM-2304, to vary the pitch according to P1, IBP must be monitored by the PRESS1 socket.

MENU

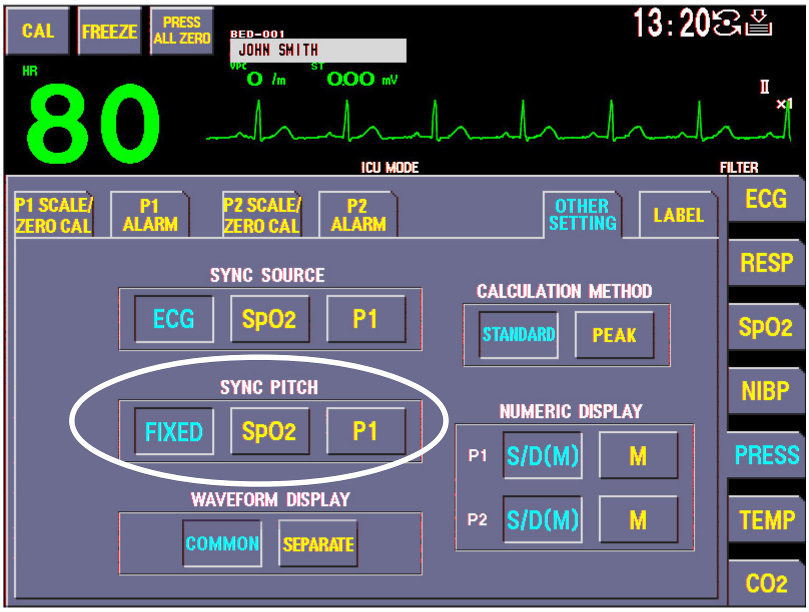


1. Press the MENU key on the front panel to display the MENU window.

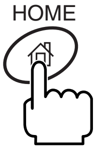
2. Touch the “PRESS” key. The PRESS P1 ALARM window appears.


CAL
FREEZE
PRESS ALL ZERO
BED-001
JOHN SMITH
VPC
0 /m
ST
0.00 mV
13:20
HR
80
II
×1
ICU MODE
FILTER
P1 SCALE/ ZERO CAL
P1 ALARM
P2 SCALE/ ZERO CAL
P2 ALARM
OTHER SETTING
LABEL
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
mmHg
SYS
175
OFF
90
DIA
104
OFF
OFF
MEAN
129
OFF
60
300
200
100
0

3. Touch the “OTHER SETTING” tab to display the OTHER SETTING window.


CAL
FREEZE
PRESS ALL ZERO
BED-001
JOHN SMITH
VPC
0 /m
ST
0.00 mV
13:20
HR
80
II
×1
ICU MODE
FILTER
P1 SCALE/ ZERO CAL
P1 ALARM
P2 SCALE/ ZERO CAL
P2 ALARM
OTHER SETTING
LABEL
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
SYNC SOURCE
ECG
SpO2
P1
CALCULATION METHOD
STANDARD
PEAK
SYNC PITCH
FIXED
SpO2
P1
NUMERIC DISPLAY
P1
S/D(M)
M
P2
S/D(M)
M
WAVEFORM DISPLAY
COMMON
SEPARATE

4. Touch the “FIXED”, “SpO_2” or “P1” key in the SYNC PITCH box to select the sync pitch.

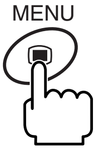


5. Press the HOME key on the front panel to return to the monitoring screen.

Selecting the Mode for Calculating IBP

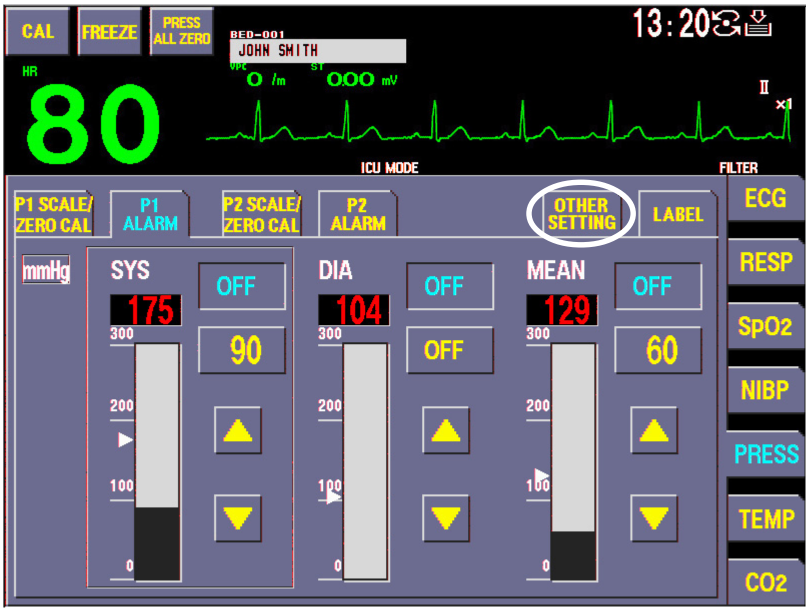
There are two calculation modes for displaying the IBP values.

STANDARD:	The IBP values are calculated by moving average. The monitor averages the latest 8 consecutive pulses and displays this average as the IBP value. When a new pulse is detected, the IBP value is recalculated using the latest 8 pulses. The IBP value display is updated every 3 seconds.
PEAK:	The systolic, diastolic and mean values of the highest pulse wave in the latest 8 consecutive pulses are displayed as the IBP values. The IBP value display is updated every 3 seconds.

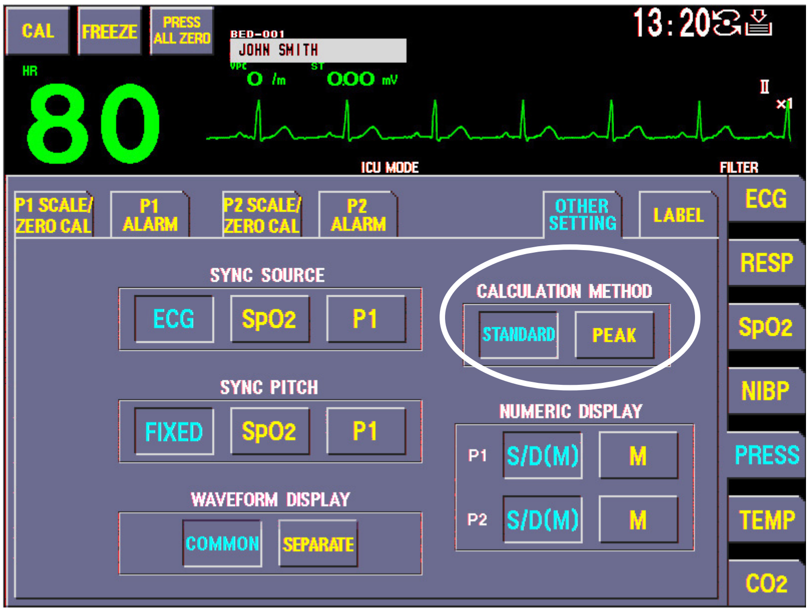


1. Press the MENU key on the front panel to display the MENU window.

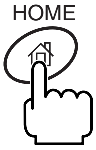
2. Touch the “PRESS” key. The PRESS P1 ALARM window appears.


CAL
FREEZE
PRESS ALL ZERO
BED-001
JOHN SMITH
13:20
HR
80
VPC
0 /m
ST
0.00 mV
II
×1
ICU MODE
FILTER
P1 SCALE/ ZERO CAL
P1 ALARM
P2 SCALE/ ZERO CAL
P2 ALARM
OTHER SETTING
LABEL
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
mmHg
SYS
175
OFF
90
DIA
104
OFF
OFF
MEAN
129
OFF
60
300
200
100
0

3. Touch the “OTHER SETTING” tab to display the OTHER SETTING window.


CAL
FREEZE
PRESS ALL ZERO
BED-001
JOHN SMITH
13:20
HR
80
VPC
0 /m
ST
0.00 mV
II
×1
ICU MODE
FILTER
P1 SCALE/ ZERO CAL
P1 ALARM
P2 SCALE/ ZERO CAL
P2 ALARM
OTHER SETTING
LABEL
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
SYNC SOURCE
ECG
SpO2
P1
SYNC PITCH
FIXED
SpO2
P1
WAVEFORM DISPLAY
COMMON
SEPARATE
CALCULATION METHOD
STANDARD
PEAK
NUMERIC DISPLAY
P1
S/D(M)
M
P2
S/D(M)
M

4. Touch the “STANDARD” or “PEAK” key in the CALCULATION METHOD box.



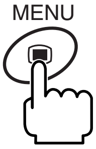
5. Press the HOME key on the front panel to return to the monitoring screen.

Selecting the Data Display Mode

The display mode of the IBP values can be selected for the monitoring screen. Select this display mode for every blood pressure line.

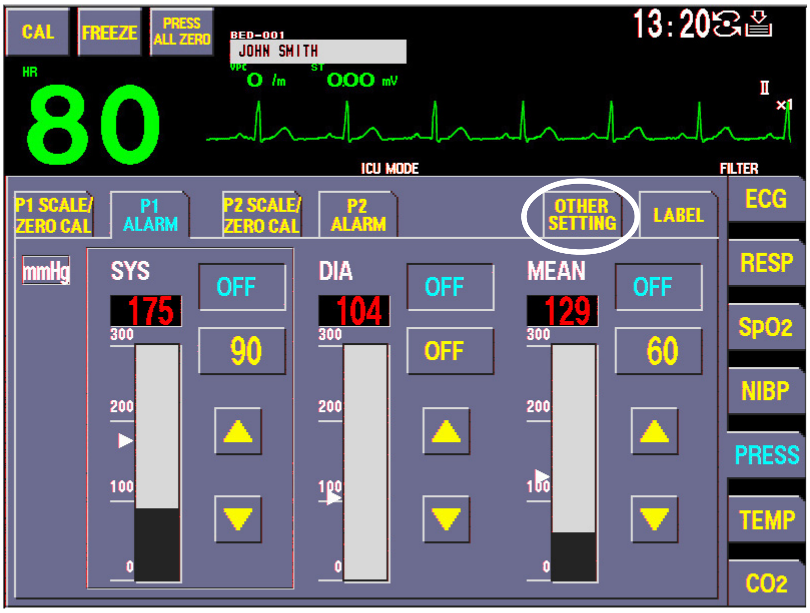
S/D (M):	Displays the systolic blood pressure (S), diastolic blood pressure (D) and the averaged blood pressure (M).
M:	Displays only the averaged blood pressure.

When “M” is selected, systolic and diastolic values appear on the screen when a systolic or diastolic alarm occurs.

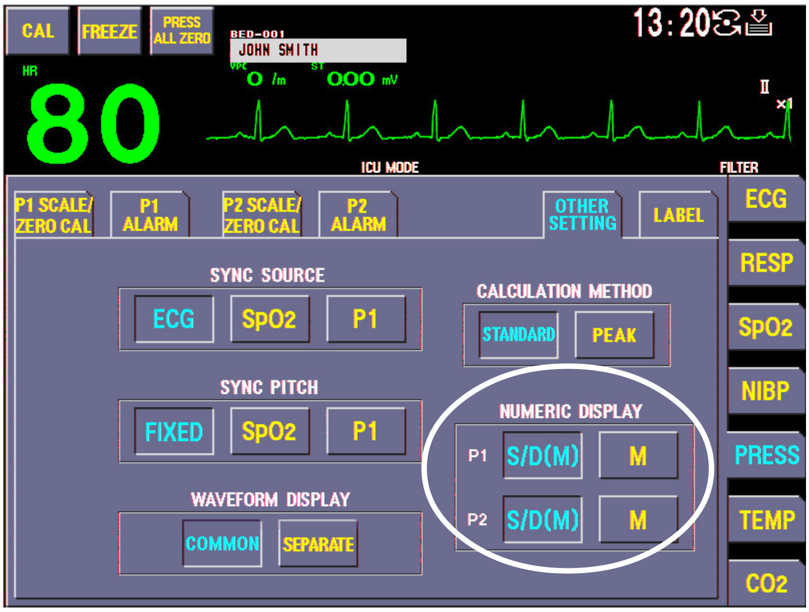


1. Press the MENU key on the front panel to display the MENU window.

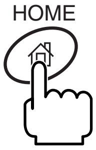
2. Touch the “PRESS” key. The PRESS P1 ALARM window appears.


CAL
FREEZE
PRESS ALL ZERO
BED-001
JOHN SMITH
13:20
HR
80
VPC 0 /m
ST 0.00 mV
II
×1
ICU MODE
FILTER
P1 SCALE/ ZERO CAL
P1 ALARM
P2 SCALE/ ZERO CAL
P2 ALARM
OTHER SETTING
LABEL
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
mmHg
SYS
175
OFF
90
DIA
104
OFF
OFF
MEAN
129
OFF
60
300
200
100
0

3. Touch the “OTHER SETTING” tab to display the OTHER SETTING window.


CAL
FREEZE
PRESS ALL ZERO
BED-001
JOHN SMITH
13:20
HR
80
VPC 0 /m
ST 0.00 mV
II
×1
ICU MODE
FILTER
P1 SCALE/ ZERO CAL
P1 ALARM
P2 SCALE/ ZERO CAL
P2 ALARM
OTHER SETTING
LABEL
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
SYNC SOURCE
ECG
SpO2
P1
SYNC PITCH
FIXED
SpO2
P1
WAVEFORM DISPLAY
COMMON
SEPARATE
CALCULATION METHOD
STANDARD
PEAK
NUMERIC DISPLAY
P1
S/D(M)
M
P2
S/D(M)
M

4. Touch the “S/D (M)” or “M” key for each blood pressure line in the NUMERIC DISPLAY box.

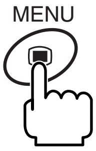


5. Press the HOME key on the front panel to return to the monitoring screen.

Changing the IBP Waveform Display Mode

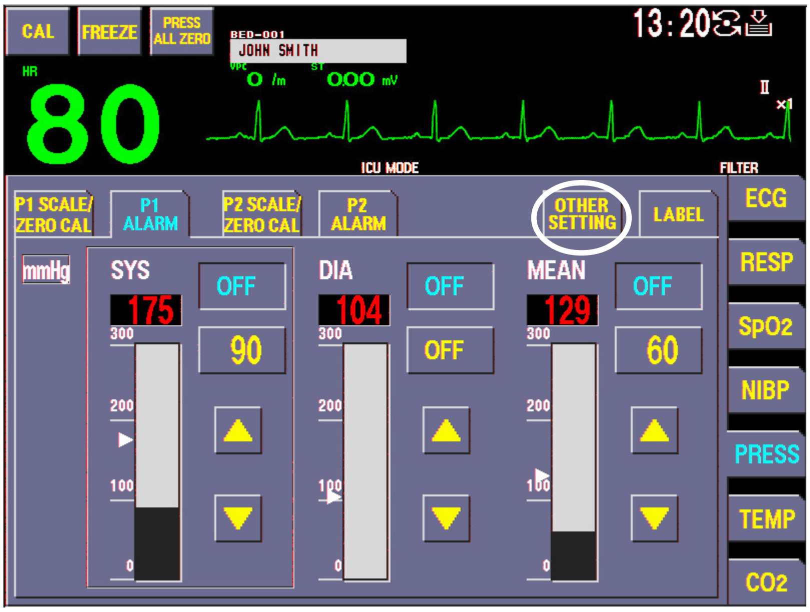
There are two ways for displaying IBP waveforms on the monitoring screen.

COMMON:	Both IBP waveforms are displayed on the same scale.
SEPARATE:	IBP waveforms are displayed separately on different scales.

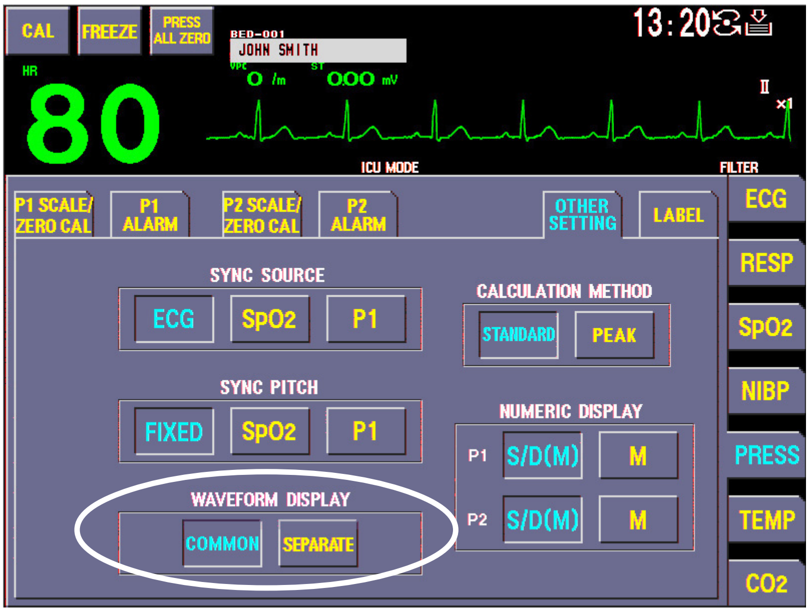


1. Press the MENU key on the front panel to display the MENU window.

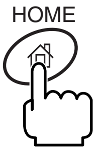
2. Touch the “PRESS” key. The PRESS P1 ALARM window appears.


CAL
FREEZE
PRESS ALL ZERO
BED-001
JOHN SMITH
13:20
HR
80
VPC 0 /m
ST 0.00 mV
II
×1
ICU MODE
FILTER
P1 SCALE/ ZERO CAL
P1 ALARM
P2 SCALE/ ZERO CAL
P2 ALARM
OTHER SETTING
LABEL
mmHg
SYS
175
OFF
90
DIA
104
OFF
OFF
MEAN
129
OFF
60
300
200
100
0
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2

3. Touch the “OTHER SETTING” tab to display the OTHER SETTING window.


CAL
FREEZE
PRESS ALL ZERO
BED-001
JOHN SMITH
13:20
HR
80
VPC 0 /m
ST 0.00 mV
II
×1
ICU MODE
FILTER
P1 SCALE/ ZERO CAL
P1 ALARM
P2 SCALE/ ZERO CAL
P2 ALARM
OTHER SETTING
LABEL
SYNC SOURCE
ECG
SpO2
P1
CALCULATION METHOD
STANDARD
PEAK
SYNC PITCH
FIXED
SpO2
P1
NUMERIC DISPLAY
P1
S/D(M)
M
P2
S/D(M)
M
WAVEFORM DISPLAY
COMMON
SEPARATE
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2

4. Touch the “COMMON” or “SEPARATE” key in the WAVEFORM DISPLAY box.



5. Press the HOME key on the front panel to return to the monitoring screen.

Changing the Label

Label the site name of the blood pressure line to be identified by the monitor.
At shipment, the blood pressure line is labeled PRESS. You can use this, but it is recommended to label the site properly for proper processing of the waveform.

The label is saved in memory in the connector of the IBP connection cord.
Once the label is set, you don't need to set the label again when the IBP connection cord is connected to a different multi-parameter socket on the monitor.

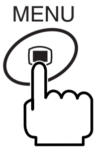
Setting labels is important for the following reasons.

- Prevents confusion of the blood pressure lines
- The pulse rate is counted according to the priority of the blood pressure labels.

Types of Labels

There are 13 labels.

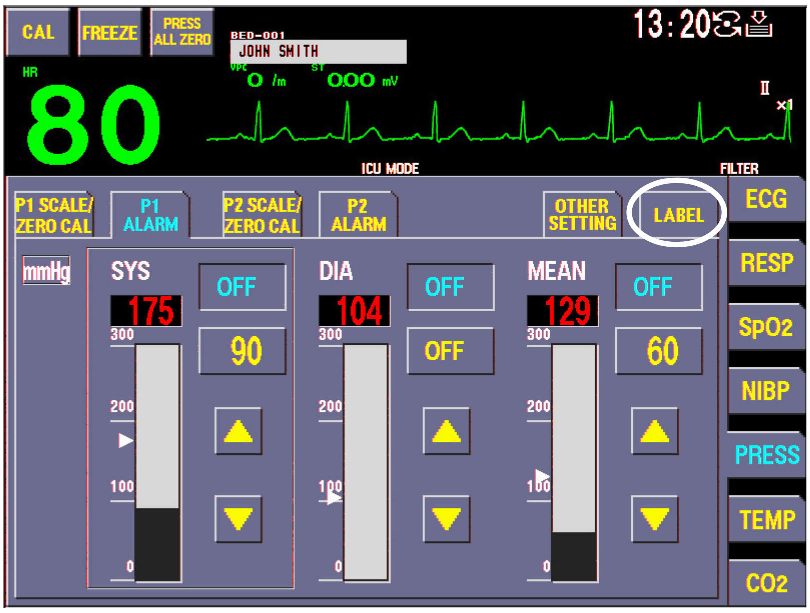
ART:	Arterial Pressure
RAD:	Radial Artery Pressure
DORS:	Dorsal Artery Pressure
AO:	Aortic Pressure
FEM:	Femoral Artery Pressure
UA:	Umbilical Artery Pressure
UV:	Umbilical Vein Pressure
PAP:	Pulmonary Artery Pressure
CVP:	Central Venous Pressure
RAP:	Right Atrial Pressure
RVP:	Right Ventricular Pressure
PRESS:	Others
ICP:	Intracranial Pressure



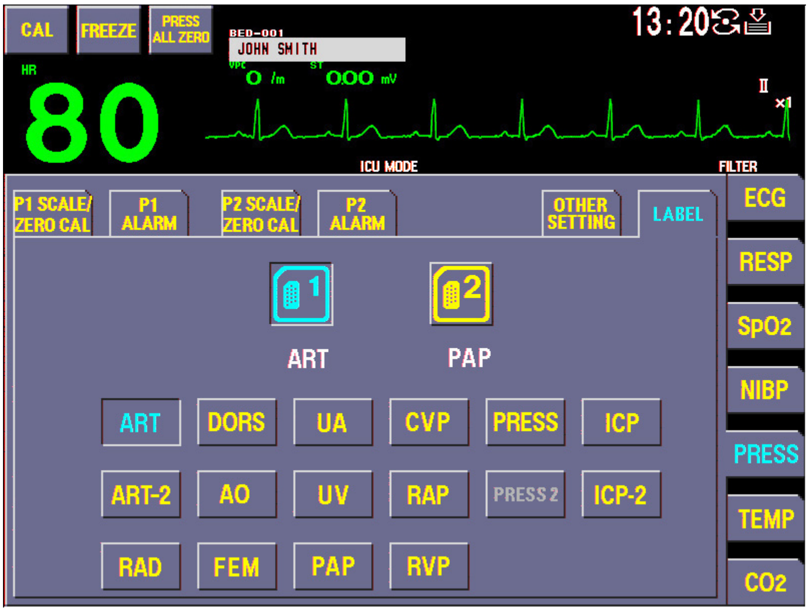
Changing the Labels

1. Press the MENU key on the front panel to display the MENU window.

2. Touch the "PRESS" key. The PRESS P1 ALARM window appears.


CAL
FREEZE
PRESS ALL ZERO
BED-001
JOHN SMITH
13:20
HR
80
VPC 0 /m
ST 0.00 mV
II
×1
ICU MODE
FILTER
P1 SCALE/ ZERO CAL
P1 ALARM
P2 SCALE/ ZERO CAL
P2 ALARM
OTHER SETTING
LABEL
mmHg
SYS
175
OFF
90
DIA
104
OFF
OFF
MEAN
129
OFF
60
300
200
100
0
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2

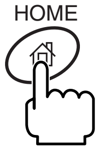
3. Touch the “LABEL” tab to display the LABEL window.


CAL
FREEZE
PRESS ALL ZERO
BED-001
JOHN SMITH
13:20
HR
80
VPC 0 /m
ST 0.00 mV
II
×1
ICU MODE
FILTER
P1 SCALE/ ZERO CAL
P1 ALARM
P2 SCALE/ ZERO CAL
P2 ALARM
OTHER SETTING
LABEL
1
2
ART
PAP
ART
DORS
UA
CVP
PRESS
ICP
ART-2
AO
UV
RAP
PRESS 2
ICP-2
RAD
FEM
PAP
RVP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2

4. Touch the key corresponding to the socket to which the IBP connection cord of the blood pressure line you want to label is connected. On the BSM-2304 monitor, “1” is for the PRESS1 socket and “2” is for the multi-parameter socket. On the BSM-2301/2351 monitor, only “1” is available.

5. Select the label appropriate for the blood pressure line.

6. Press the HOME key on the front panel to return to the monitoring screen.



7. Attach the blood pressure site label to the connector of the IBP connection cord.

Section 15 CO_2 Monitoring

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  Measurement Error with the TG-900P/TG-920P CO_2 Sensor Kit 15.2
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General

CO_2 monitoring by the mainstream method is performed by connecting the TG-900P, TG-920P or TG-950P CO_2 sensor kit to the patient's respiration circuit or directly to the patient and to the multi-parameter socket on the monitor. When monitoring with the TG-950P CO_2 sensor kit, $FiCO_2$ is also monitored.

Mainstream Method

In the mainstream method, the sensor is located directly in the respiration circuit. There are three sensors for two different calculation methods.

Semi-quantitative method using the TG-900P/TG-920P CO_2 sensor kit
Measurements are based on the assumption of no CO_2 gas in the inspiration. The CO_2 concentration in the respiration is calculated by taking the CO_2 concentration in the inspiration as 0 mmHg.

Quantitative method using the TG-950P CO_2 sensor kit
The CO_2 partial pressure in both inspiration and expiration is measured.

The mainstream CO_2 measurement method has the following merits and limits compared to the sidestream method. Understand these points when performing measurements.

Merits

- No delay in the measurement time.
- Measurement is stable over a long period of time.
- No measurement error due to mixture of water droplets.

Limits

- TG-900P/950P CO_2 sensor kit cannot be used on non-intubated patients.
- Due to the weight of the TG-900P/950P CO_2 sensor kit, load is easily imposed on the tracheal tube.
- The dead space volume is relatively large.

CAUTION

- **The measurement may be inaccurate when the monitor is used for patients with an extremely high respiration rate or patients with irregular respiration. Read the measured values carefully.**
- **When monitoring CO_2 of a patient under anesthesia, make sure that the gas composition is entered. Otherwise the measurement result may be inaccurate.**
- **When using an anesthetic instrument with a volatile anesthetic agent, the CO_2 measurement may be inaccurate.**

When using N_2O anesthetic gas (nitrous oxide), set the gas composition at GAS window. Refer to the "Setting the Inspiration Composition" section.

Measurement Error with the TG-900P/TG-920P CO_2 Sensor Kit

With the TG-900P/TG-920P CO_2 sensor kit, measurements are based on the assumption that the inspiration contains no CO_2 gas. Consequently, when CO_2 gas mixes in the inspiration, measured values will be lower than normal.

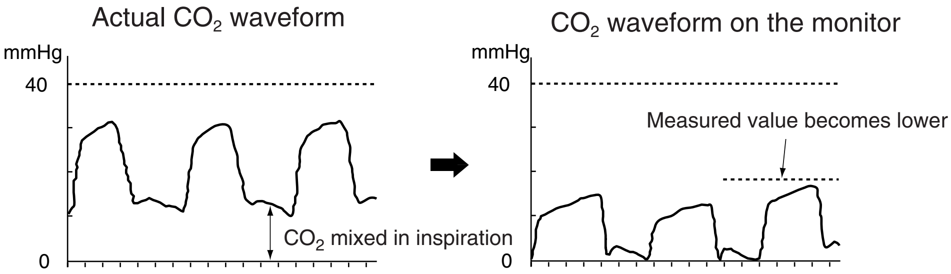
WARNING

With the TG-900P CO_2 sensor kit, measurements are based on the assumption of no CO_2 gas in the inspiration. The CO_2 concentration in the respiration is calculated by taking the CO_2 concentration in the inspiration as 0 mmHg. Therefore, measuring CO_2 by connecting the CO_2 sensor kit to a Jackson Rees circuit, Mapleson D circuit or any other respiration circuit where CO_2 gas may be present during inspiration may result in the acquired data being lower than the actual value.

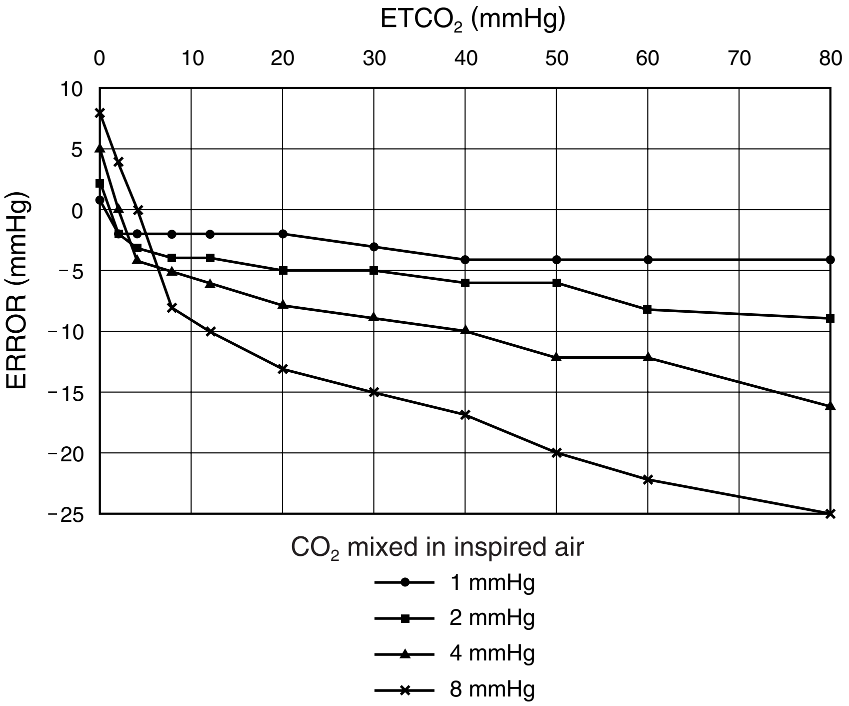
CAUTION

With the TG-920P CO_2 sensor kit, measurements are based on the assumption of no CO_2 gas in the inspiration. The CO_2 concentration in the respiration is calculated by taking the CO_2 concentration in the inspiration as 0 mmHg. Therefore, measuring CO_2 of a patient with an oxygen mask where CO_2 gas may be present in the inspiration gas may result in the acquired data being lower than the actual value.

When CO_2 is mixed in inspiration



Measurement Error when CO_2 is Mixed in the Inspired Air



Preparing for CO_2 Monitoring

Preparation Flowchart

1. Select the CO_2 sensor kit and airway adapter/nasal adapter.

2. Connect the CO_2 sensor kit to the multi-parameter socket on the monitor.

NOTE

On BSM-2304, CO_2 cannot be monitored when connected to the PRESS1 socket.

3. Connect the CO_2 sensor to the respiration circuit.

4. Start measurement and change necessary settings.

For handling accessories after use, refer to Section 18.

Types of CO_2 Sensor Kit

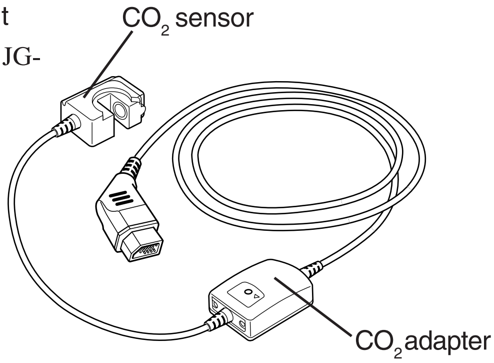
There are three types of CO_2 sensor kit for CO_2 mainstream monitoring.

Model	Method	Attachment
TG-900P	Semi-quantitative	Used on an intubated patient
TG-920P	Semi-quantitative	Attach to the patient nose
TG-950P	Quantitative	Used on an intubated patient

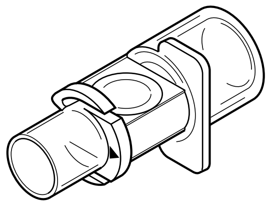
Using TG-900P CO_2 Sensor Kit

The TG-900P CO_2 sensor kit measures the partial pressure of the expired CO_2 of an intubated patient by the semi-quantitative method. It consists of a TG-101T CO_2 sensor and JG-900P CO_2 adapter. It requires a YG-101T airway adapter for monitoring CO_2.

TG-900P CO_2 Sensor Kit
TG-101T CO_2 sensor with JG-900P CO_2 adapter



YG-101T Airway Adapter



Model	Patient	Weight	Dead space volume	Code No.
YG-101T	Adult	10 kg or more	5 cc	R801

WARNING

- **When using the YG-101T airway adapter on children or patients with low ventilatory amount, the CO$_2$ may mix in the inspiration due to the airway adapter's dead space volume (5 mL), resulting in inaccurate measured values or difficulty in detecting apnea. Perform ventilation taking into consideration the 5 mL dead space volume. Do not use the airway adapter on neonates.**
- **The measurements are based on the assumption of no CO$_2$ gas in the inspiration. The CO$_2$ concentration in the respiration is calculated by taking the CO$_2$ concentration in the inspiration as 0 mmHg. Therefore, measuring CO$_2$ by connecting the CO$_2$ sensor kit to a Jackson Rees circuit, Mapleson D circuit or any other respiration circuit where CO$_2$ gas may be present during inspiration may result in the acquired data being lower than the actual value.**

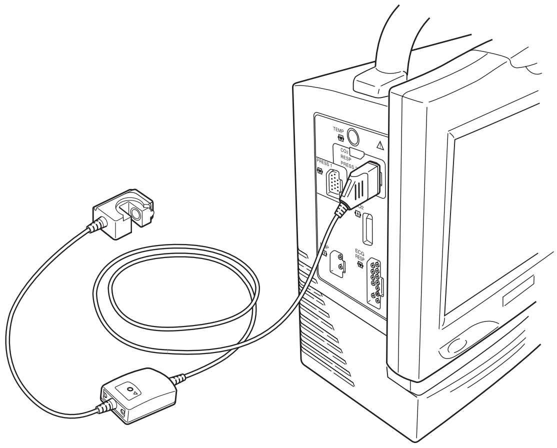
CAUTION

- **With the TG-900P CO$_2$ sensor kit, this monitor cannot monitor CO$_2$ of patients younger than 3 years old or weighing less than 10 kg (22 lbs).**
- **The airway adapter is non-sterilized and disposable. Use only for single patient and single use. Failure to follow this instruction causes cross infection.**

NOTE

The measurement may be inaccurate when monitored in the following conditions. Read the measured values carefully.

1. **When used in environments with high concentration nitrous oxide gas.**
2. **When used in places with low atmospheric pressure such as at high altitude.**
3. **When used in environments with sudden temperature changes.**
4. **When used in environments with severe humidity.**
5. **When used for patients with irregular spontaneous respiration.**



Connecting the CO$_2$ Sensor Kit to the Monitor

Connect the CO$_2$ sensor kit to the multi-parameter socket on the monitor.

NOTE

On BSM-2304, CO$_2$ cannot be monitored when connected to the PRESS1 socket.

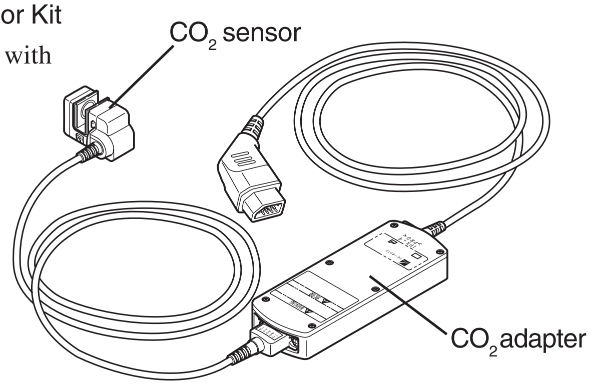
Connecting the CO$_2$ Adapter to the Respiration Circuit

Refer to the TG-900P CO$_2$ sensor kit and airway adapter manual.

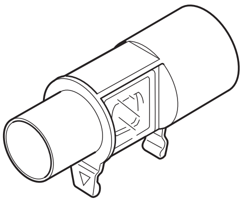
Using TG-950P CO_2 Sensor Kit

The TG-950P CO_2 sensor kit measures the partial pressure of the expired CO_2 of an intubated patient by the quantitative method. It consists of a TG-201T CO_2 sensor and JG-950P CO_2 adapter. It requires a YG-201T or YG-202T airway adapter for monitoring CO_2.

TG-950P CO_2 Sensor Kit
TG-201T CO_2 sensor with
JG-950P CO_2 adapter



YG-201T/202T Airway Adapter



Model	Patient	Weight	Dead space volume	Code No.
YG-201T	Adult	10 kg or more	5 cc	R802
YG-202T	Pediatric	3 to 10 kg	2 cc	R803

WARNING

- **When using the YG-201T airway adapter on patients with low ventilatory amount, the CO_2 may mix in the inspiration due to the airway adapter's dead space volume (5 mL), resulting in inaccurate measured values or difficulty in detecting apnea. Perform ventilation taking into consideration the 5 mL dead space volume.**
- **When using the YG-202T airway adapter on children or patients with low ventilatory amount, perform ventilation taking the airway adapter's dead space volume (2 mL) into consideration.**
- **Select the airway adapter taking the patient weight and ventilation volume into consideration. If an inappropriate airway adapter is used, the resistance in the respiration circuit increases or the measurement value is incorrect.**

CAUTION

- **The airway adapter is non-sterilized and disposable. Use only for single patient and single use. Failure to follow this instruction causes cross infection.**
- **When the environment temperature changes greatly, it requires about 30 minutes to obtain accurate CO_2 measurement.**

NOTE

The measurement may be inaccurate when monitored in the following conditions. Read the measured values carefully.

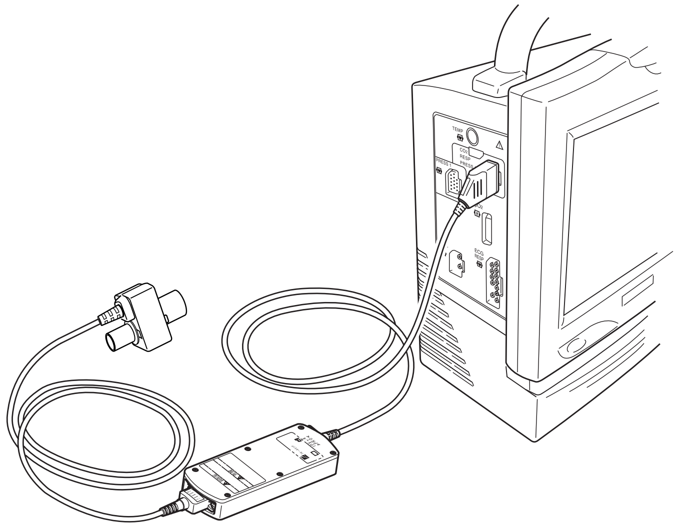
1. **When used in environments with high concentration nitrous oxide gas.**
2. **When used in environments with sudden temperature changes.**
3. **When used in environments with severe humidity.**

Connecting the CO_2 Sensor Kit to the Monitor

Connect the CO_2 sensor kit to the multi-parameter socket on the monitor.

NOTE

On BSM-2304, CO_2 cannot be monitored when connected to the PRESS1 socket.



Connecting the CO_2 Adapter to the Respiration Circuit

Refer to the TG-950P CO_2 sensor kit and airway adapter manual.

Performing Zero Calibration

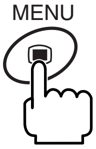
When using the TG-950P CO_2 sensor kit, perform zero calibration in the following conditions.

- When the airway adapter is replaced with a new one.
- When a different type of airway adapter is used.
- When the operating temperature changes.
- When the measurement room is changed.
- Whenever necessary.

Zero calibration can be performed in two ways: calibration with air and calibration with N_2 gas. Both methods are performed on the CO_2 window.

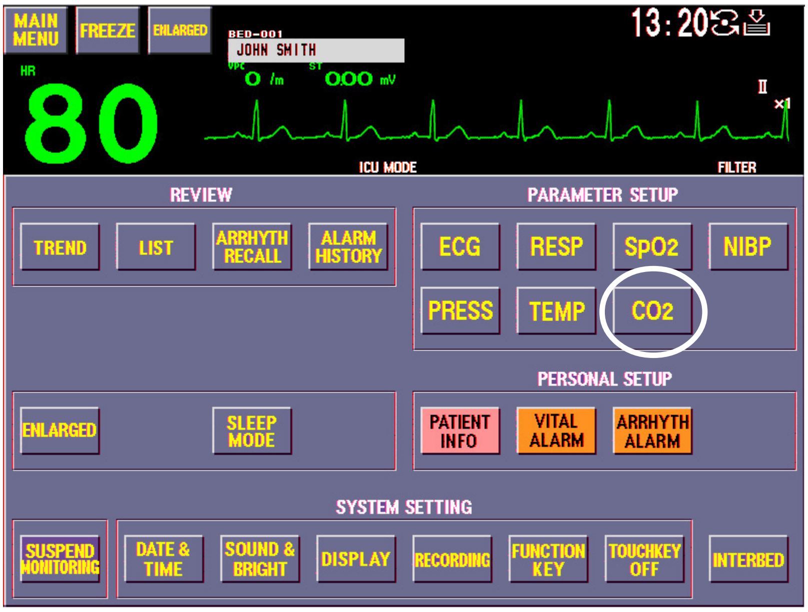
- Calibration with air
  Expose the airway adapter to air. Calibrates with about 0.2 mmHg CO_2 in the air.
- Calibration with N_2 gas
  Flow N_2 gas into the airway adapter.

The calibrated value is saved in memory in the connector of the CO_2 sensor kit. Once calibrated, you don't need to calibrate again when connecting the CO_2 sensor kit to the socket of a different module.



Calibrating by Air

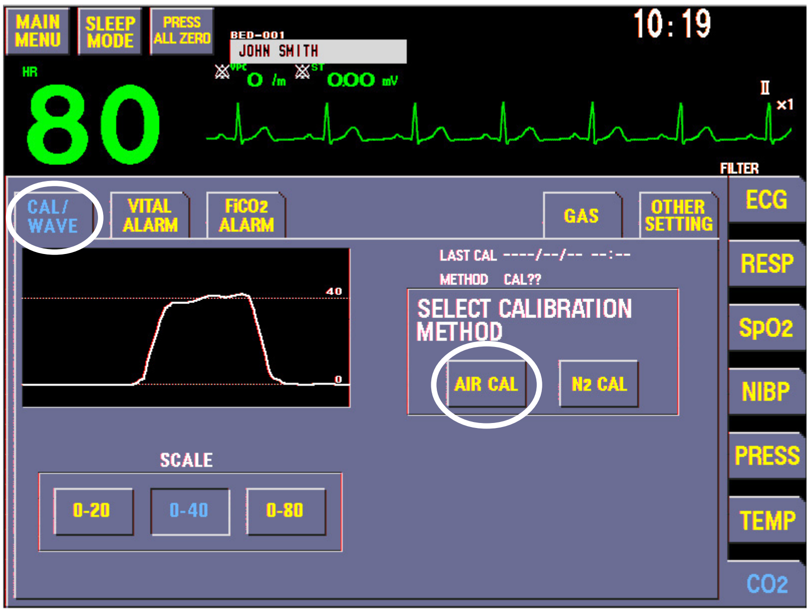
1. Press the MENU key on the front panel to display the MENU window.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC
0 /m
ST
0.00 mV
II
×1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
ENLARGED
SLEEP MODE
PERSONAL SETUP
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

2. Touch the "CO2" key. The CO_2 window appears.

   When zero calibration is not yet performed, the CAL/WAVE window appears.

   When zero calibration is already performed, the CO_2 VITAL ALARM window appears. Touch the "CAL/WAVE" tab to display the CAL/WAVE window.


MAIN MENU
SLEEP MODE
PRESS ALL ZERO
BED-001
JOHN SMITH
10:19
HR
80
VPC
0 /m
ST
0.00 mV
II
×1
FILTER
CAL/ WAVE
VITAL ALARM
FiCO2 ALARM
GAS
OTHER SETTING
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
LAST CAL ----/--/-- --:--
METHOD CAL??
SELECT CALIBRATION METHOD
AIR CAL
N2 CAL
40
0
SCALE
0-20
0-40
0-80

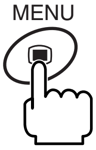
3. Touch the “AIR CAL” key in the SELECT CALIBRATION METHOD box. The TG-950P CO$_2$ sensor kit must be connected to the monitor for the SELECT CALIBRATION METHOD box to be displayed on the CO$_2$ window.

4. Expose the airway adapter to air and touch the “YES” key. The “CALIBRATING” message appears. When the “CALIBRATION COMPLETE” message is displayed, calibration is complete.

Calibrating with N$_2$ Gas

For handling the N$_2$ gas cylinder, refer to the N$_2$ gas manual.

1. Connect the airway adapter to the N$_2$ gas cylinder.

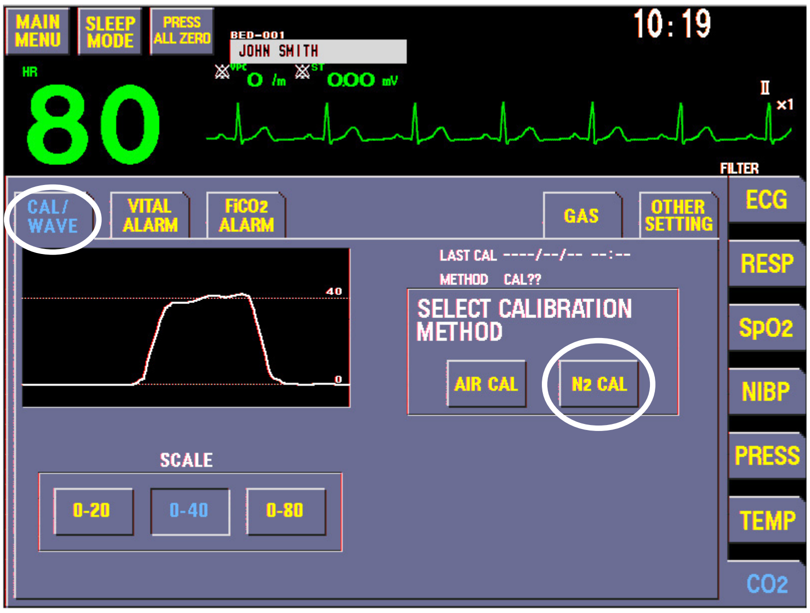


2. Press the MENU key on the front panel to display the MENU window.

3. Touch the “CO$_2$” key. The CO$_2$ window appears.

   When zero calibration is not yet performed, the CAL/WAVE window appears.

   When zero calibration is already performed, the CO$_2$ VITAL ALARM window appears. Touch the “CAL/WAVE” tab to display the CAL/WAVE window.


MAIN MENU
SLEEP MODE
PRESS ALL ZERO
BED-001
JOHN SMITH
10:19
HR
80
VPC 0 /m
ST 0.00 mV
II
×1
FILTER
CAL/ WAVE
VITAL ALARM
FiCO2 ALARM
GAS
OTHER SETTING
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
40
0
LAST CAL ----/--/-- --:--
METHOD CAL??
SELECT CALIBRATION METHOD
AIR CAL
N2 CAL
SCALE
0-20
0-40
0-80

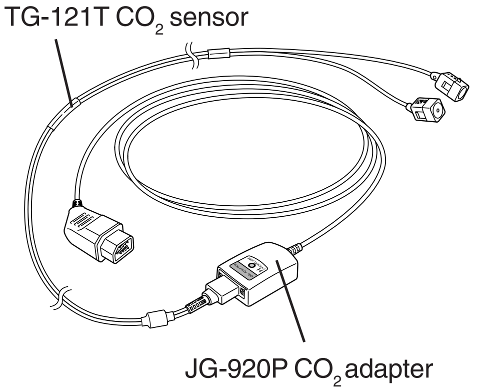
4. Touch the "N_2 CAL" key in the SELECT CALIBRATION METHOD box. The TG-950P CO_2 sensor kit must be connected to the monitor for the SELECT CALIBRATION METHOD box to be displayed on the CO_2 window.

5. Open the N_2 gas cylinder so that the N_2 gas flows into the airway adapter.

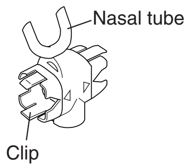
6. Touch the "YES" key to start calibration. The "CALIBRATING" message appears. When the "CALIBRATION COMPLETE" message is displayed, calibration is complete.

Using TG-920P CO_2 Sensor Kit

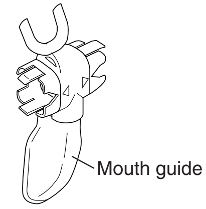
The TG-920P CO_2 sensor kit measures the partial pressure of the expired CO_2 of a patient who is not intubated by the semi-quantitative method. It consists of a TG-121T CO_2 sensor and JG-920P CO_2 adapter. It requires a YG-120T, YG-121T or YG-122T nasal adapter for monitoring CO_2.



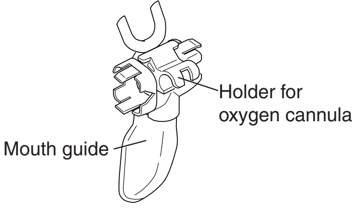
YG-120T
(for nasal breathing)



YG-121T
(for naso-oral)



YG-122T
(for oxygen cannula)



Model	Patient	Weight	Dead space volume	Code No.
YG-120T	Older than 3 years	10 kg or more	1.2 mL	V921
YG-121T				V922
YG-122T				V923

NOTE

- **Only use the oxygen cannula manufactured by HUDSON RCI®. Do not use any other oxygen cannula. For the specific models, refer to the CO_2 sensor kit manual.**
- **Oxygen delivery of the oxygen cannula must be under 5 L/min. Otherwise CO_2 cannot be correctly measured because the oxygen flow affects the expired gas flow.**

WARNING

When using the YG-120T/121T/122T nasal adapter on children or patients with low ventilatory amount, the CO_2 may mix in the inspiration due to the nasal adapter's dead space volume (1.2 mL), resulting in inaccurate measured values or difficulty in detecting apnea. Perform ventilation taking into consideration the 1.2 mL dead space volume.

CAUTION

- **With the TG-920P CO_2 sensor kit, this monitor cannot monitor CO_2 of patients younger than 3 years old or weighing less than 10 kg (22 lbs).**
- **With the TG-920P CO_2 sensor kit, measurements are based on the assumption of no CO_2 gas in the inspiration. The CO_2 concentration in the respiration is calculated by taking the CO_2 concentration in the inspiration as 0 mmHg. Therefore, measuring CO_2 of a patient with an oxygen mask where CO_2 gas may be present in the inspiration gas may result in the acquired data being lower than the actual value.**
- **The nasal adapter is non-sterilized and disposable. Use only for single patient and single use. Failure to follow this instruction causes cross infection.**

- **Stop using the oxygen cannula with the CO_2 sensor kit when arterial oxygen saturation does not increase.**
- **When using the YG-121T/122T nasal adapter on a patient with bleeding disorder, poor general medical condition or malnutrition, observe the patient condition all the time. The mouth guide touches the mouth and may cause pressure sores.**

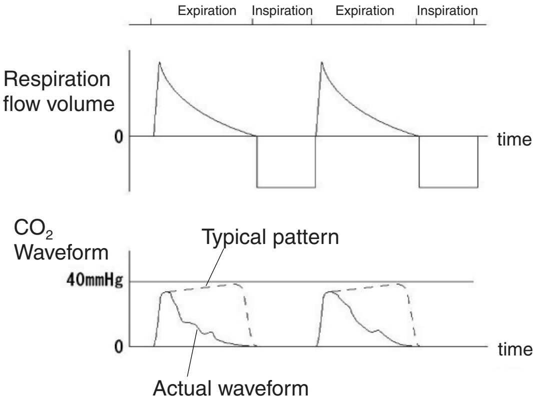
NOTE

The measurement may be inaccurate when monitored in the following conditions. Read the measured values carefully.

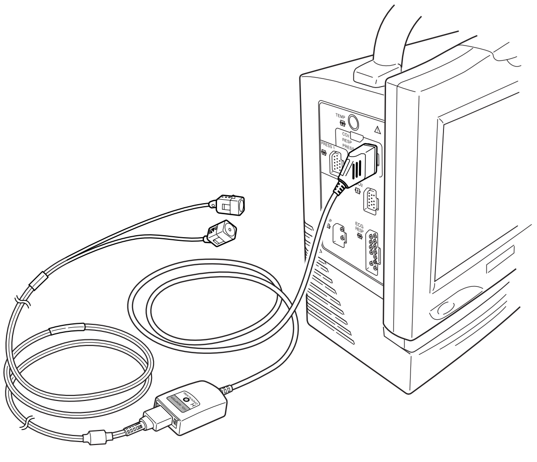
1. **When used in environments with high concentration nitrous oxide gas.**
2. **When used in environments with sudden temperature changes.**
3. **When used in environments with severe humidity.**

When Using Oxygen Cannula

As the graphs show, the expired volume is decreased at the end of expiration. If too much oxygen is supplied or oxygen is directly delivered to the nose, the oxygen flow affects the expired gas flow. Therefore, the actual CO_2 waveform will be inaccurate (the solid line in the graph) compared with the typical pattern (the dashed line).



Connecting CO_2 Sensor Kit to the Monitor



Connect the CO_2 sensor kit to the multi-parameter socket on the monitor.

NOTE

On BSM-2304, CO_2 cannot be monitored when connected to the PRESS1 socket.

Attaching the CO_2 Sensor Kit to the Patient

Refer to the operator’s manuals for the CO_2 sensor kit and nasal adapter.

Monitoring CO_2

After completing the preparation, CO_2 data and waveforms appear on the screen.

CAUTION

- **When using an anesthetic instrument with volatile anesthetic agent, the CO_2 measurement may become inaccurate.**
- **When the "CHANGE ADAPTER" or "CHANGE SENSOR" message is displayed, check the CO_2 sensor kit and replace with a new one when necessary. CO_2 cannot be monitored while the message is displayed.**

When Using TG-900P/TG-920P CO_2 Sensor Kit

NOTE

This monitor performs calibration automatically every minute and in the following conditions.

- **At the monitor power on**
- **Patient's first respiration**
- **The airway adapter/nasal adapter is removed from the CO_2 sensor and connected again**
- **Respiration stopped for 20 seconds**
- **Signal changed rapidly due to temperature change**

During calibration, the CO_2 waveform appears as the calibrated waveform, but the respiration rate and measured value are not affected.

When Using TG-950P CO_2 Sensor Kit

NOTE

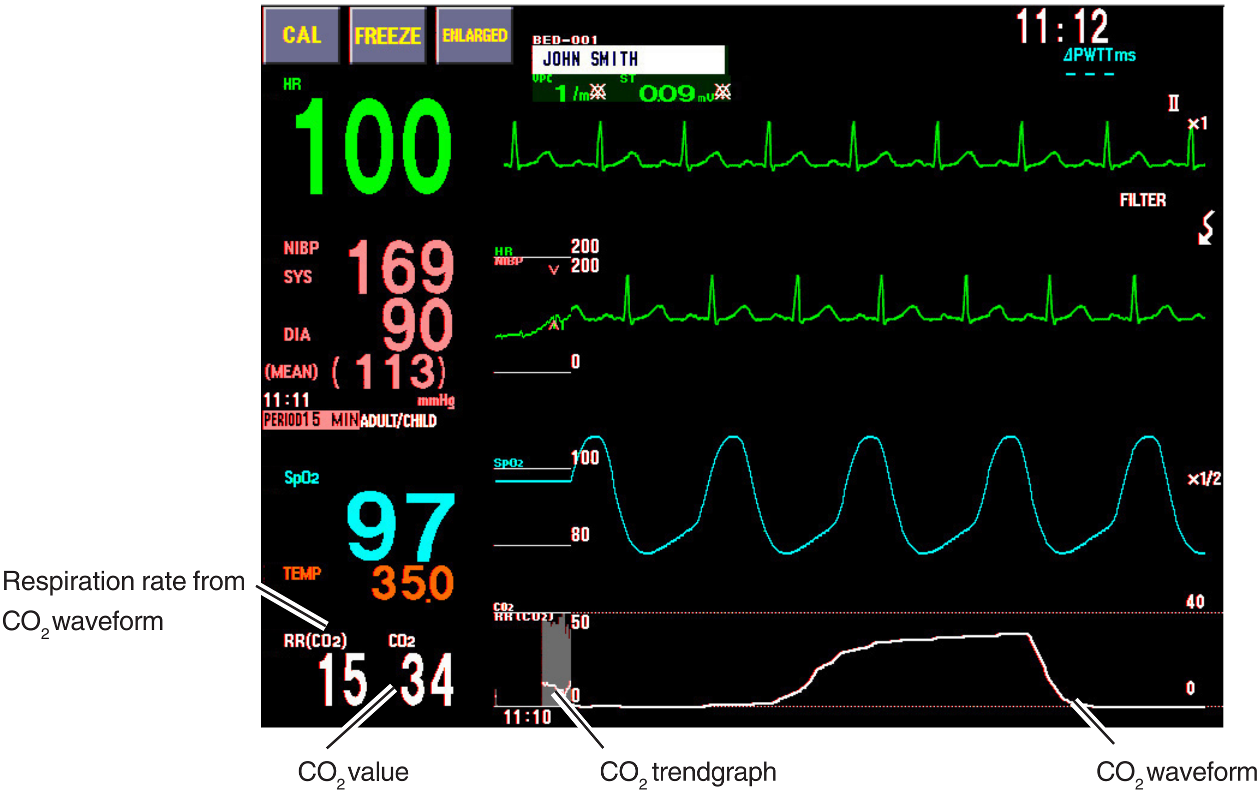
Perform calibration in the following conditions.

- **When the airway adapter is replaced with a new one.**
- **When a different type of airway adapter is used.**
- **When the operating temperature changes.**
- **When the measurement room is changed.**
- **Whenever necessary.**

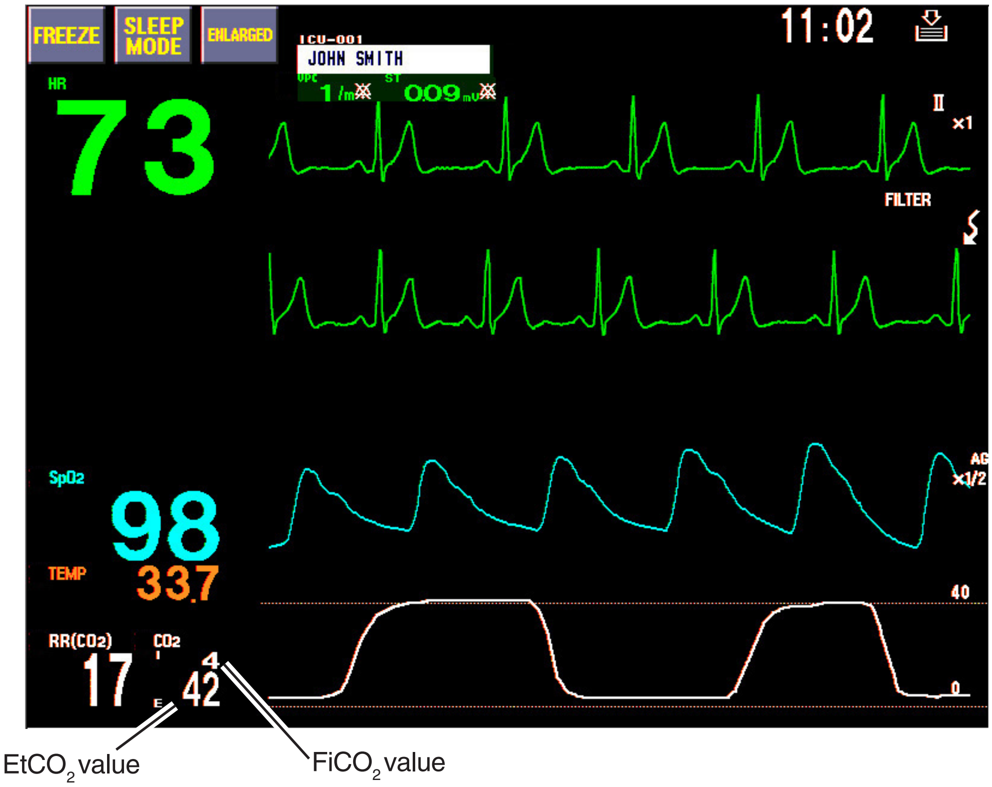
For error messages and monitoring problems, refer to Section 17.

CO_2 Information on the Monitoring Screen

Monitoring with the TG-900P/920P CO_2 sensor kit


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
VPC 1 /m
ST 0.09 mV
11:12
ΔPWTT ms
HR
100
II
×1
FILTER
NIBP
SYS
169
DIA
90
(MEAN) (113)
11:11
mmHg
PERIOD 15 MIN
ADULT/CHILD
HR
NIBP
200
200
0
SpO2
100
80
×1/2
SpO2
97
TEMP
35.0
CO2
RR(CO2)
50
40
0
RR(CO2)
15
CO2
34
11:10
Respiration rate from CO_2 waveform
CO_2 value
CO_2 trendgraph
CO_2 waveform

Monitoring with the TG-950P CO_2 sensor kit


FREEZE
SLEEP MODE
ENLARGED
ICU-001
JOHN SMITH
VPC 1 /m
ST 0.09 mV
11:02
HR
73
II
×1
FILTER
SpO2
98
AG
×1/2
TEMP
33.7
40
0
RR(CO2)
17
CO2
I
4
E
42
$EtCO_2$ value
$FiCO_2$ value

Changing CO$_2$ Settings

Change the settings on the CO$_2$ window. The following settings can be changed for CO$_2$ monitoring.

- Scale
- CO$_2$ waveform sweep speed
- Respiration rate, apnea, EtCO$_2$ and FiCO$_2$ alarm settings
- Inspiration composition

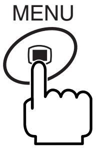
The CO$_2$ unit (mmHg or kPa) is the same as the pressure unit. The pressure unit is set on the SYSTEM SETUP screen. Refer to Section 3.

Changing the Respiration Alarm Limits

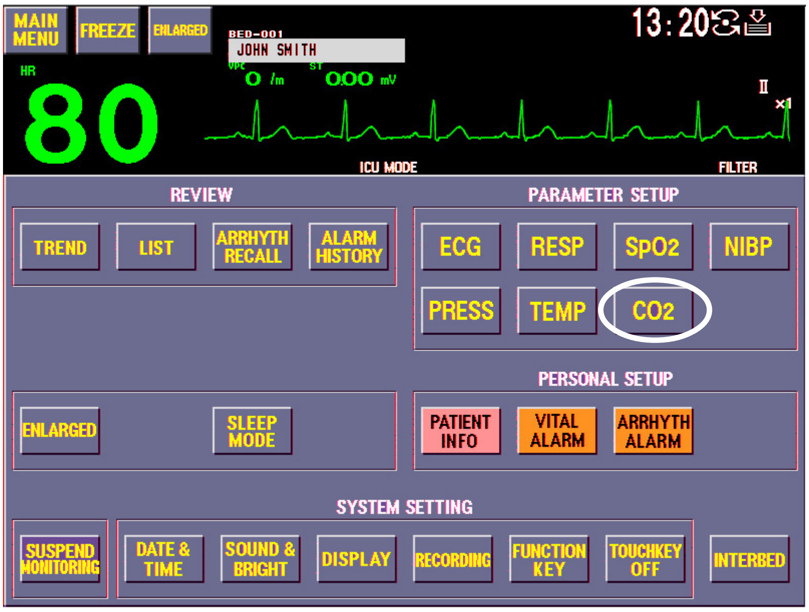
CAUTION

When the upper or lower alarm limit is turned off, there will be no respiration rate upper or lower alarm for that limit.

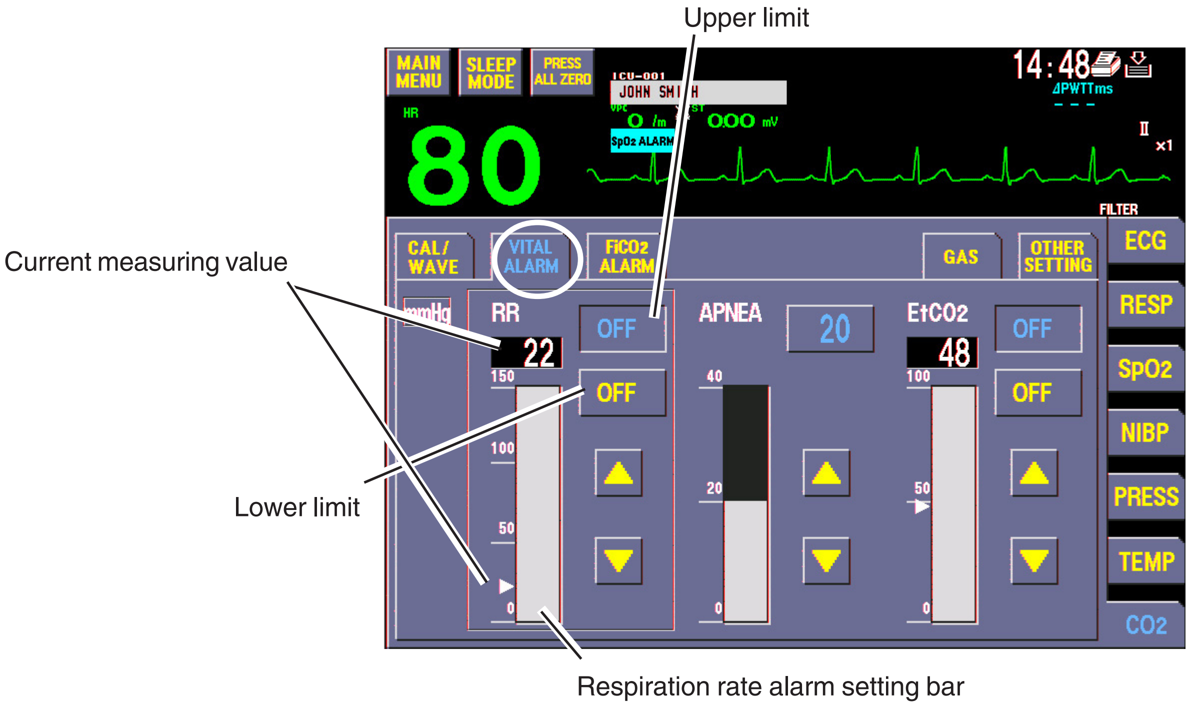
You can set the upper and lower respiration rate alarm limits on this window. Other alarm items must be set on the VITAL ALARM window. You can set all alarms, including the upper and lower respiration rate alarm limits, on the VITAL ALARM window (See Section 6).



1. Press the MENU key on the front panel to display the MENU window.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC
0 /m
ST
0.00 mV
II
×1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

2. Touch the “CO$_2$” key. The CO$_2$ VITAL ALARM window appears.

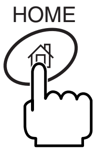

Upper limit
Current measuring value
Lower limit
Respiration rate alarm setting bar
MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
14:48
ΔPWTTms
HR
80
SpO2 ALARM
0.00 mV
FILTER
CAL/ WAVE
VITAL ALARM
FiCO2 ALARM
GAS
OTHER SETTING
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
mmHg
RR
22
OFF
OFF
150
100
50
0
APNEA
20
40
20
0
EtCO2
48
OFF
OFF
100
50
0

3. Touch the respiration rate alarm setting bar.

4. Touch the upper limit box to set the upper limit or touch the lower limit box to set the lower limit.

5. Touch the desired level on the setting bar. Touch the ▲ or ▼ key to adjust the setting.

   If the upper limit is set to a value above the maximum or the lower limit is set to a value below the minimum, the alarm is set to OFF.



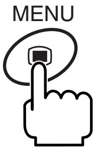
6. Press the HOME key on the front panel to return to the monitoring screen.

Changing the Apnea Alarm Limit

CAUTION

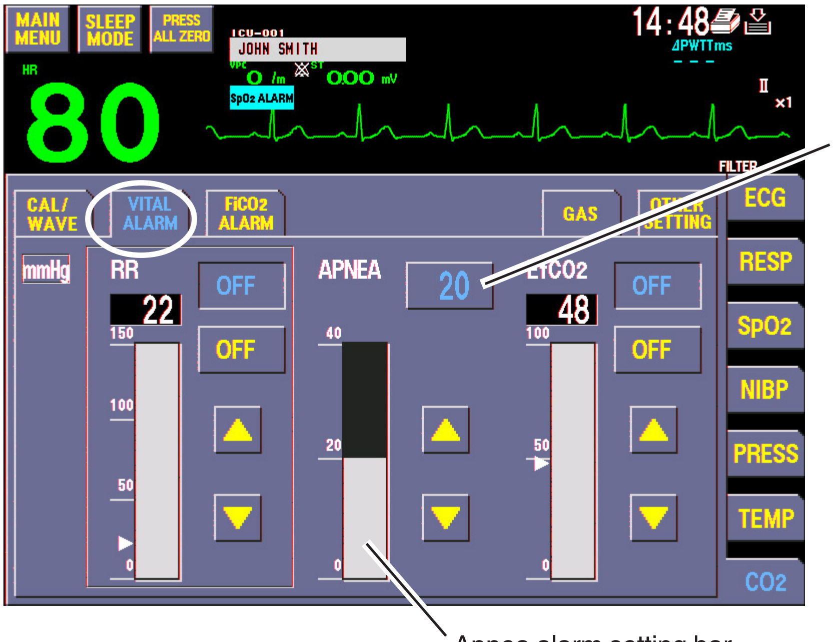
When the alarm limit is turned off, there will be no apnea alarm.

You can set the apnea alarm limit on the CO_2 window. You can set all alarms, including the apnea alarm limit, on the VITAL ALARM window (See Section 6).



1. Press the MENU key on the front panel to display the MENU window.

2. Touch the “CO_2” key. The CO_2 VITAL ALARM window appears.

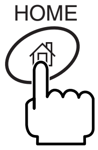

MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
14:48
ΔPWTTms
HR
80
SpO2 ALARM
0.00 mV
II
x1
FILTER
CAL/ WAVE
VITAL ALARM
FiCO2 ALARM
GAS
OTHER SETTING
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
mmHg
RR
22
OFF
OFF
150
100
50
0
APNEA
20
40
20
0
EtCO2
48
OFF
OFF
100
50
0

Apnea alarm limit

Apnea alarm setting bar

3. Touch the apnea alarm setting bar.

4. Touch the desired level on the setting bar. Touch the ▲ or ▼ key to adjust the setting.



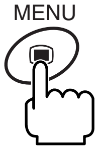
5. Press the HOME key on the front panel to return to the monitoring screen.

Changing the EtCO$_2$ Alarm Limits

CAUTION

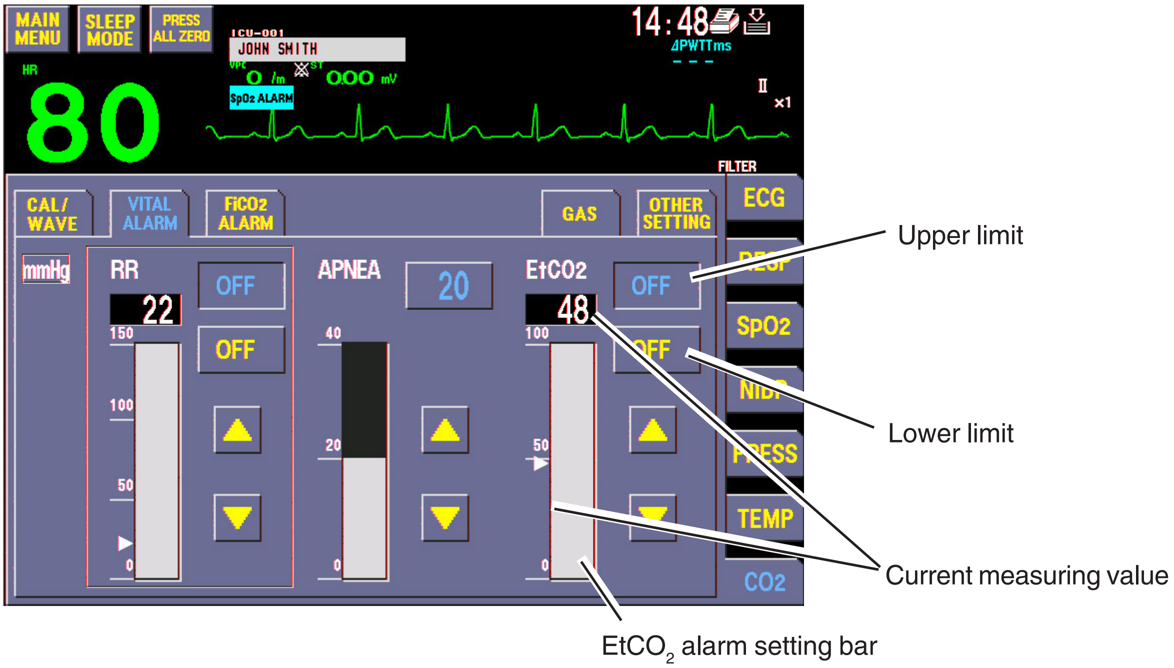
When the upper or lower alarm limit is turned off, there will be no EtCO$_2$ upper or lower alarm for that limit.

You can set the upper and lower EtCO$_2$ alarm limits on this window. Other alarm items must be set on the VITAL ALARM window. You can set all alarms, including the upper and lower EtCO$_2$ alarm limits, on the VITAL ALARM window (See Section 6).



1. Press the MENU key on the front panel to display the MENU window.

2. Touch the “CO$_2$” key. The CO$_2$ VITAL ALARM window appears.


MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
14:48
ΔPWTTms
HR
80
VPC
0 /m
ST
0.00 mV
SpO2 ALARM
II
x1
FILTER
CAL/ WAVE
VITAL ALARM
FiCO2 ALARM
GAS
OTHER SETTING
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
mmHg
RR
22
OFF
OFF
150
100
50
0
APNEA
20
40
20
0
EtCO2
48
OFF
OFF
100
50
0
Upper limit
Lower limit
Current measuring value
EtCO2 alarm setting bar

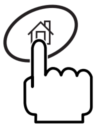
3. Touch the $EtCO_2$ alarm setting bar to change the $EtCO_2$ alarm setting.

4. Touch the upper limit box to set the upper limit or touch the lower limit box to set the lower limit.

5. Touch the desired level on the setting bar. Touch the ▲ or ▼ key to adjust the setting.

   If the upper limit is set to a value above the maximum or the lower limit is set to a value below the minimum, the alarm is set to OFF.

HOME



6. Press the HOME key on the front panel to return to the monitoring screen.

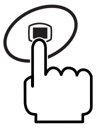
Changing the $FiCO_2$ Alarm Limits

CAUTION

When the upper or lower alarm limit is turned off, there will be no $FiCO_2$ upper or lower alarm for that limit.

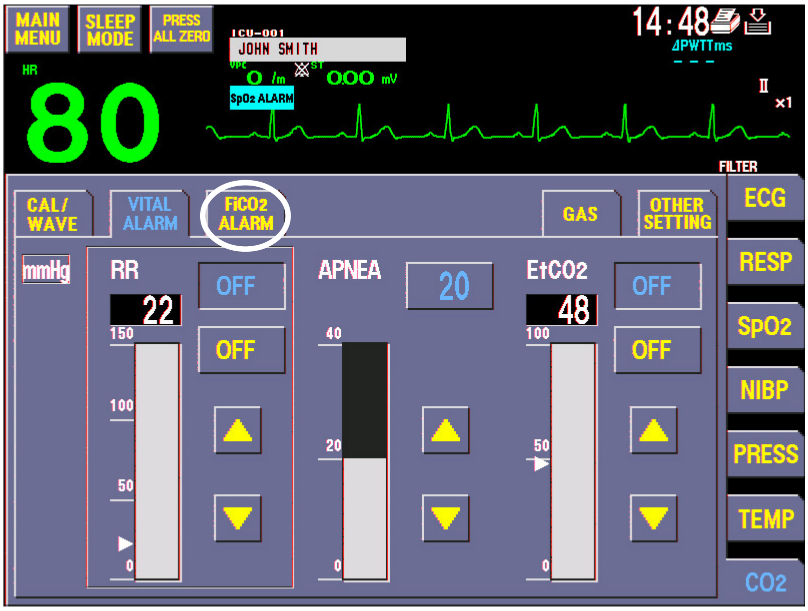
You can set the upper and lower $FiCO_2$ alarm limits on this window. Other alarm items must be set on the VITAL ALARM window. You can set all alarms, including the upper and lower $FiCO_2$ alarm limits, on the VITAL ALARM window (See Section 6). $FiCO_2$ alarm limits can only be set when using a TG-950P CO_2 sensor kit.

MENU

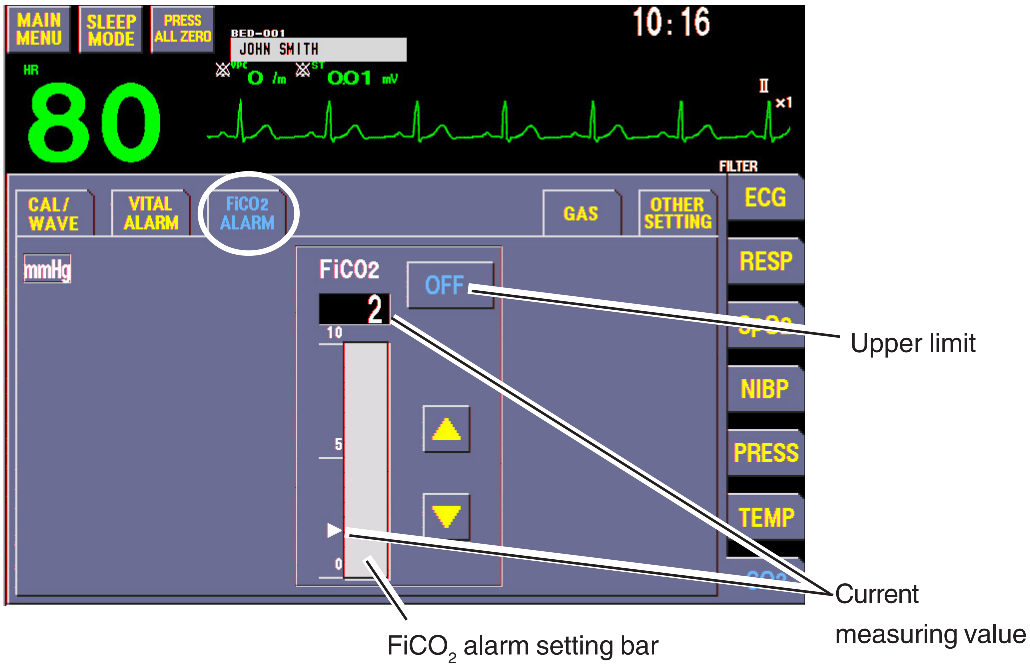


1. Press the MENU key on the front panel to display the MENU window.

2. Touch the "CO_2" key. The CO_2 VITAL ALARM window appears.


MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
14:48
ΔPWTTms
HR
80
0 /m
0.00 mV
SpO2 ALARM
II ×1
FILTER
CAL/ WAVE
VITAL ALARM
FiCO2 ALARM
GAS
OTHER SETTING
mmHg
RR
22
OFF
OFF
150
100
50
0
APNEA
20
40
20
0
EtCO2
48
OFF
OFF
100
50
0
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2

3. Touch the “$FiCO_2$ ALARM” tab to display the $FiCO_2$ ALARM window.


MAIN MENU
SLEEP MODE
PRESS ALL ZERO
BED-001
JOHN SMITH
10:16
HR
80
0 /m
0.01 mV
II ×1
FILTER
CAL/ WAVE
VITAL ALARM
FiCO2 ALARM
GAS
OTHER SETTING
mmHg
FiCO2
2
OFF
10
5
0
ECG
RESP
NIBP
PRESS
TEMP

Upper limit

Current measuring value

$FiCO_2$ alarm setting bar

4. Touch the $FiCO_2$ alarm setting bar to change the $FiCO_2$ alarm setting.

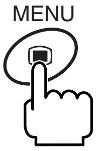
5. Touch the upper limit box to set the upper limit.

6. Touch the desired level on the setting bar. Touch the ▲ or ▼ key to adjust the setting.

   If the upper limit is set to a value above the maximum, the alarm is set to OFF.

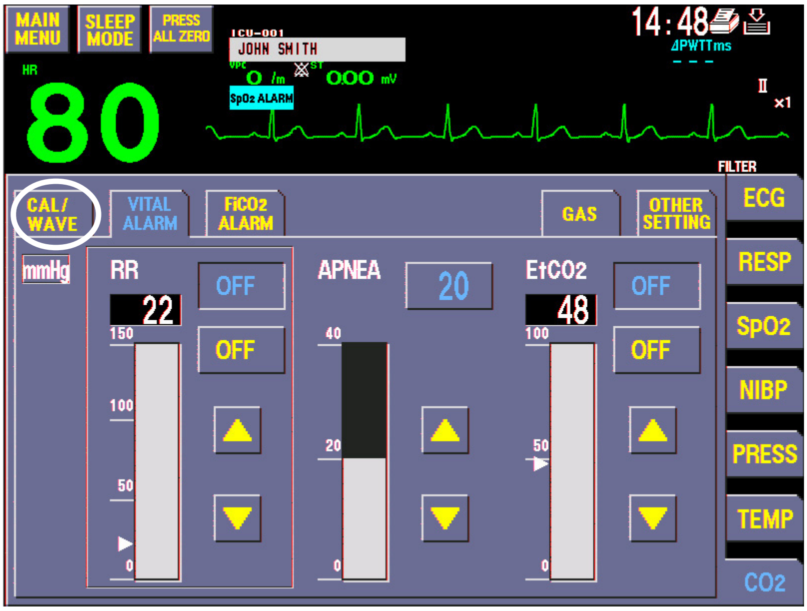
7. Press the HOME key on the front panel to return to the monitoring screen.

Changing the CO_2 Scale

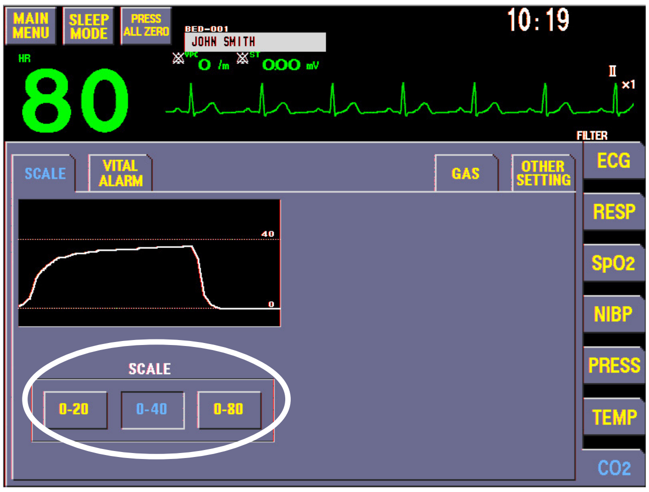


1. Press the MENU key on the front panel to display the MENU window.

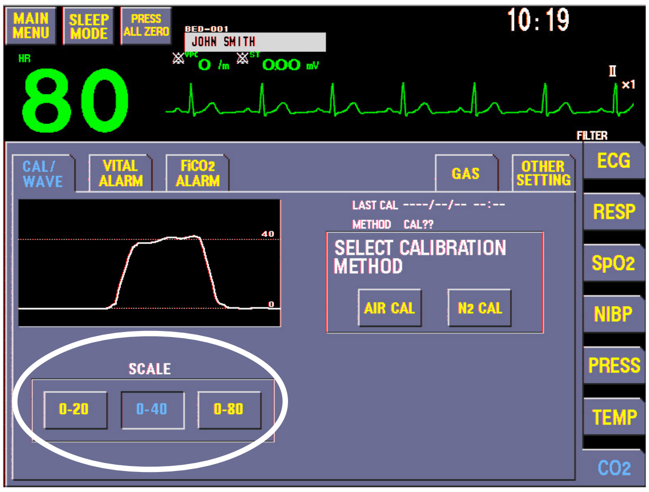
2. Touch the “CO_2” key. The CO_2 VITAL ALARM window appears.


MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
14:48
ΔPWTTms
HR
80
VPC
0 /m
ST
0.00 mV
SpO2 ALARM
II
×1
FILTER
CAL/ WAVE
VITAL ALARM
FiCO2 ALARM
GAS
OTHER SETTING
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
mmHg
RR
22
OFF
OFF
150
100
50
0
APNEA
20
40
20
0
EtCO2
48
OFF
OFF
100
50
0

3. Touch the “SCALE” or “CAL/WAVE” tab to display the SCALE or CAL/WAVE window.

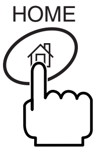

MAIN MENU
SLEEP MODE
PRESS ALL ZERO
BED-001
JOHN SMITH
10:19
HR
80
VPC
0 /m
ST
0.00 mV
II
×1
FILTER
SCALE
VITAL ALARM
GAS
OTHER SETTING
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
40
0
SCALE
0-20
0-40
0-80

When using TG-900P/920P CO_2 sensor kit


MAIN MENU
SLEEP MODE
PRESS ALL ZERO
BED-001
JOHN SMITH
10:19
HR
80
VPC
0 /m
ST
0.00 mV
II
×1
FILTER
CAL/ WAVE
VITAL ALARM
FiCO2 ALARM
GAS
OTHER SETTING
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
40
0
LAST CAL ----/--/-- --:--
METHOD CAL??
SELECT CALIBRATION METHOD
AIR CAL
N2 CAL
SCALE
0-20
0-40
0-80

When using TG-950P CO_2 sensor kit

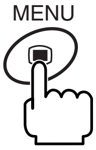
4. Select the scale by touching the desired scale key in the SCALE box.



5. Press the HOME key on the front panel to return to the monitoring screen.

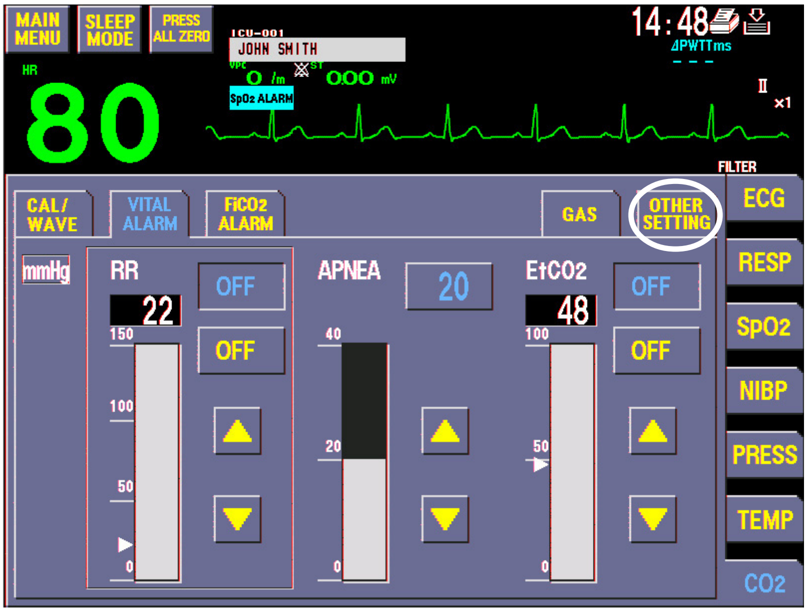
Changing the CO_2 Waveform Sweep Speed

The CO_2 waveform sweep speed on the screen can be selected from 1, 6, or 25 or 50 mm/s.

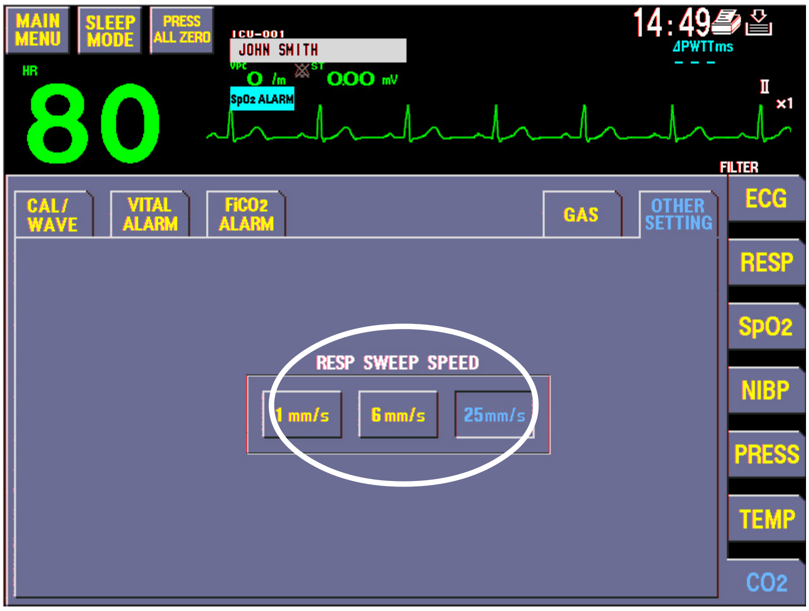


1. Press the MENU key on the front panel to display the MENU window.

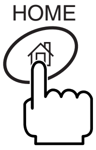
2. Touch the “CO_2” key. The CO_2 VITAL ALARM window appears.


MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
VPC
0 /m
ST
0.00 mV
SpO2 ALARM
14:48
ΔPWTTms
- - -
HR
80
II
×1
FILTER
CAL/ WAVE
VITAL ALARM
FiCO2 ALARM
GAS
OTHER SETTING
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
mmHg
RR
22
OFF
OFF
150
100
50
0
APNEA
20
40
20
0
EtCO2
48
OFF
OFF
100
50
0

3. Touch the “OTHER SETTING” tab to display the OTHER SETTING window.


MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
VPC
0 /m
ST
0.00 mV
SpO2 ALARM
14:49
ΔPWTTms
- - -
HR
80
II
×1
FILTER
CAL/ WAVE
VITAL ALARM
FiCO2 ALARM
GAS
OTHER SETTING
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
RESP SWEEP SPEED
1 mm/s
6 mm/s
25mm/s

4. Select the CO_2 waveform sweep speed from the RESP SWEEP SPEED box.



5. Press the HOME key on the front panel to return to the monitoring screen.

Setting the Inspiration Composition

When N_2O is mixed in the inspiration or when a high concentration of oxygen is inspired, sensitivity of CO_2 absorbing infrared ray is affected, and as a result measurements cannot be performed correctly. When using anesthetic gas or a respirator, set the inspiration composition. The monitor corrects the CO_2 concentration automatically according to the setting.

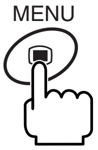
Use with Volatile Anesthetic Agent

CAUTION

- **When monitoring CO_2 of a patient under anesthesia, make sure that the gas composition is entered. Otherwise the measurement result may be inaccurate.**
- **When using an anesthetic instrument with volatile anesthetic agent, the CO_2 measurement may be inaccurate.**

When using volatile anesthetic agent, the CO_2 value is off by the following amount (at 1 atmospheric pressure, 5% (38 mmHg) CO_2 and N_2 mixture gas, no condensation).

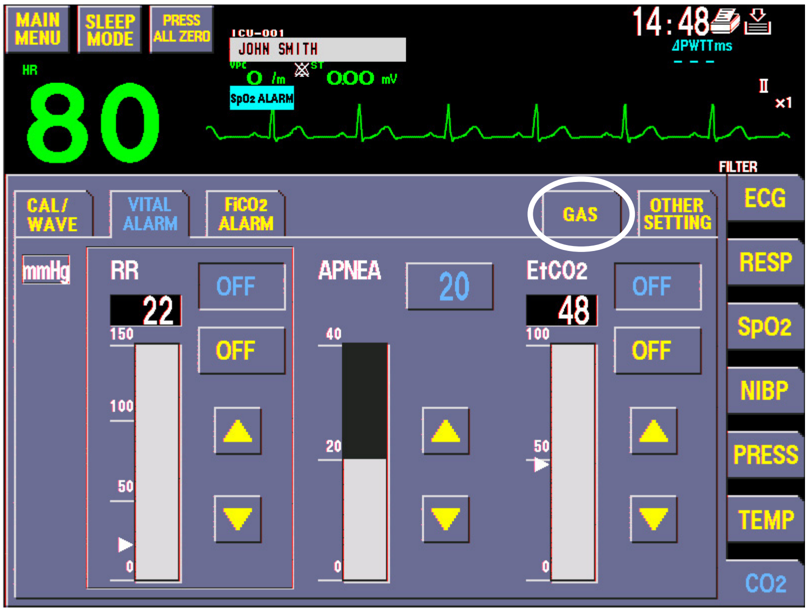
Anesthetic Gas	Concentration	Difference		
		TG-900P	TG-920P	TG-950P
Halothane	4%	+0.9 mmHg	+1 mmHg	+0.2 mmHg
Enflurane	5%	+1.5 mmHg	+1 mmHg	+0.4 mmHg
Isoflurane	5%	+1.8 mmHg	+2 mmHg	+0.8 mmHg
Sevoflurane	6%	+2.8 mmHg	+3 mmHg	+1.3 mmHg
Desflurane	24%	+7.0 mmHg	+7 mmHg	+3.2 mmHg



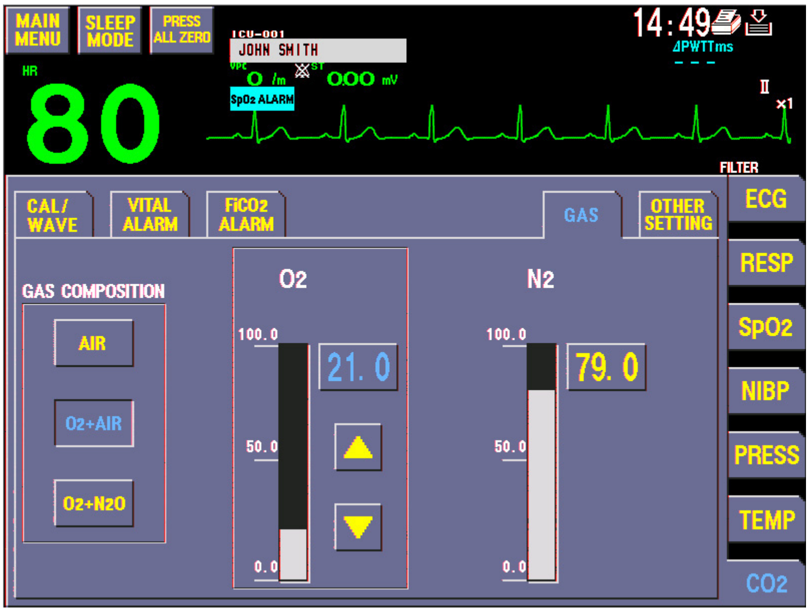
Procedure

1. Press the MENU key on the front panel to display the MENU window.

2. Touch the "CO_2" key. The CO_2 VITAL ALARM window appears.


MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
14:48
ΔPWTTms
HR
80
VPC
0 /m
ST
0.00 mV
SpO2 ALARM
II
×1
FILTER
CAL/ WAVE
VITAL ALARM
FiCO2 ALARM
GAS
OTHER SETTING
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
mmHg
RR
22
OFF
OFF
150
100
50
0
APNEA
20
40
20
0
EtCO2
48
OFF
OFF
100
50
0

3. Touch the “GAS” tab to display the GAS window.

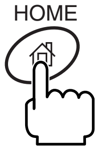

MAIN MENU
SLEEP MODE
PRESS ALL ZERO
ICU-001
JOHN SMITH
14:49
ΔPWTTms
HR
80
VPC 0 /m
ST 0.00 mV
SpO2 ALARM
II
×1
FILTER
CAL/ WAVE
VITAL ALARM
FiCO2 ALARM
GAS
OTHER SETTING
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
GAS COMPOSITION
AIR
O2+AIR
O2+N2O
O2
100.0
50.0
0.0
21.0
N2
100.0
50.0
0.0
79.0

4. Set the composition of the inspired gas.
   - When not using gas that influences measurement
     → Touch the “AIR” key.
   - When using respirator and anesthesia device
     → Touch the “O$_2$+AIR” key and set the O$_2$ ratio.

     To set the O$_2$ ratio:
     i) Touch the O$_2$ setting bar.
     ii) Touch the desired level on the setting bar. Touch the ▲ or ▼ key to adjust the setting.

   - When using anesthetic gas
     → Touch the “O$_2$+N$_2$O” key and set the gas ratio.

     To set the gas ratio:
     i) Touch the setting bar.
     ii) Touch the desired level on the setting bar. Touch the ▲ or ▼ key to adjust the setting.



5. Press the HOME key on the front panel to return to the monitoring screen.

Inspection of Measuring Accuracy

Daily Inspection of Measuring Accuracy

Perform daily accuracy inspection using your own respiration.

Put the larger end of the airway adapter (side for connecting to the patient's mask and tracheal tube) into your mouth and after stabilizing breathing, breathe in the same way as in the resting state at a rate of 5 seconds per breath (12 breaths/ minute). Breathing too quickly or taking deep breaths will disable standard measurements.

The standard $EtCO_2$ concentration is 40 mmHg (5.3 kPa). Check that the CO_2 gas concentration display is from 35 to 45 mmHg (4.7 to 6.0 kPa).

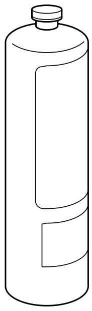
Inspection of Measuring Accuracy (Precise Method)

Check the measurement accuracy whenever you suspect the monitor is not reading correctly. This procedure does not calibrate CO_2 sensor. It only checks the measurement accuracy. If the measurement accuracy is not appropriate, contact your Nihon Kohden distributor.

The following parts are required.

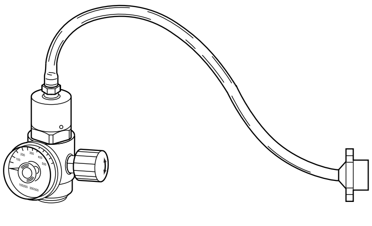
CAUTION

- **Only use the specified parts.**
- **Obey the CAUTION label on the CO_2 gas cylinder.**
- **After the lifetime of the CO_2 gas cylinder expires, the measurement accuracy cannot be guaranteed.**



- 5% CO_2 calibration gas

Manufacturer:	Nellcor Puritan Bennett or Scott Medical Products
Cylinder name:	OD (1 L disposable cylinder)
Outlet connection:	CGA 600
Gas volume:	25 L (Provides about 50 to 100 calibrations)
Gas component:	5% CO_2, 21% O_2, balance N_2
Accuracy:	±0.03% absolute
Expiration:	3 years after the gas is packed in the cylinder



- Flow regulator PR-150 flow regulator (Full scale 700 psi)

Manufacturer:	VICTOR High Purity & Instrumentation
Delivery flow (flow rate):	0.5 L/min
Inlet connection:	CGA 600

- Tube

  Internal diameter: 4 mm

- Slip joint
  Manufacturer: Portex
  Specification: 100/252 4 mm

When using a CO_2 gas cylinder and flow regulator other than the above, the following specifications must be met. Make sure that the outlet connection of the gas cylinder and the inlet connection of the flow regulator fit together.

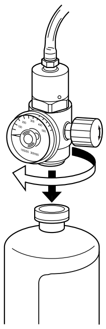
- 5% CO_2 calibration gas
  Gas component: 5% CO_2, 21% O_2, balance N_2
  Accuracy: ±0.03% absolute
- Flow regulator
  Delivery flow (flow rate): 0.5 L/min

Checking Procedure

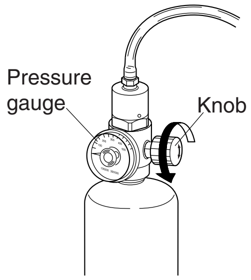
Using TG-900P CO_2 Sensor Kit

NOTE

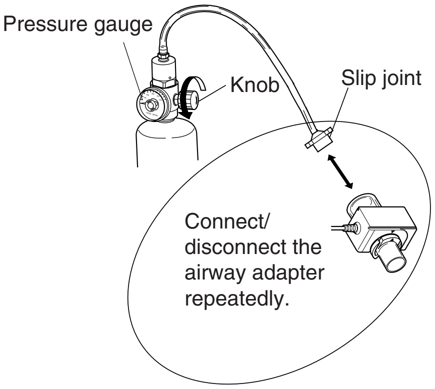
- **The monitor calculates the CO_2 concentration by assuming that the gas temperature is 37°C and the surrounding pressure is 1 atmospheric pressure. Therefore, if this checking procedure is performed at room temperature or lower, the monitor will display higher instCO_2 (there will be –0.4% per °C difference). Correspondingly, if the checking procedure is performed at high altitude, the monitor will display a lower instCO_2 reading (there will be 1 mmHg/30 hPa difference).**
- **When the pressure gauge of the flow regulator reads 0, replace the CO_2 gas cylinder with a new one.**



1. Connect the flow regulator to the CO_2 gas cylinder by rotating the flow regulator clockwise. Connect them firmly.
2. Connect the CO_2 sensor kit to the multi-parameter socket on the monitor.
3. Connect the airway adapter to the CO_2 sensor so that the ▼ marks on the airway adapter and CO_2 sensor align.



4. After checking that the CO$_2$ gas cylinder is connected properly, gently turn the knob of the flow regulator counterclockwise about half a turn to start the gas flow.



5. Connect the slip joint to the airway adapter. CO$_2$ gas flows in the airway adapter and the CO$_2$ on the screen should read 38 mmHg. (Expiration phase, 38 mmHg CO$_2$ gas)

6. Disconnect the slip joint from the airway adapter and shake the CO$_2$ sensor to remove CO$_2$ gas from the airway adapter. Open air flows into the airway adapter. Check that CO$_2$ is 0 mmHg from the CO$_2$ waveform on the screen. (Inspiration phase, no CO$_2$ gas)

CAUTION

This method assumes that no CO$_2$ gas is present in the inspiration phase of breathing. Therefore, step 6 has to be performed to simulate the inspiration phase of breathing so that the monitor can correctly determine the CO$_2$ concentration. The monitor determines the CO$_2$ concentration by comparing the change in CO$_2$ concentration in the airway adapter during the inspiration and expiration phase of breathing.

7. Repeat steps 5 and 6 a few times and compare the readings of step 5. The readings should be the same.

8. After checking, gently turn the flow regulator knob clockwise to stop the gas flow.

Using TG-950P CO$_2$ Sensor Kit

Do steps 1 to 5 and 8 of the procedure for the TG-900P CO$_2$ Sensor Kit.

Section 16 Temperature Monitoring

General 16.1
Preparing for Temperature Monitoring 16.1
    Preparation Flowchart 16.1
    Selecting the Probe 16.2
        Reusable Probes 16.2
        Disposable Probe 16.3
    Connecting Cables and Attaching the Probe 16.4
        Connecting Cable to the Monitor 16.4
        Attaching the Probe to the Patient 16.5
Monitoring Temperature 16.7
    Temperature Information on the Monitoring Screen 16.7
Changing Temperature Settings 16.8
    Changing the Temperature Alarm Limits 16.8

General

Temperature can be monitored by attaching the probe to the patient and using the TEMP socket on the monitor.

Preparing for Temperature Monitoring

Preparation Flowchart

1. Select the probe.
2. Connect the probe cord to the TEMP socket on the monitor.
3. Attach the probe to the patient.
4. Change necessary settings.
5. Start monitoring.

For handling accessories after use, refer to Section 18.

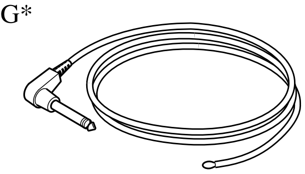
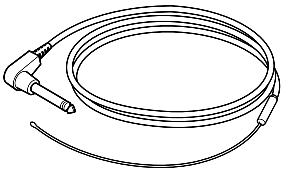
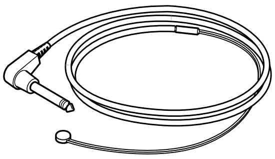
Selecting the Probe

Select the appropriate probe according to the purpose.

CAUTION

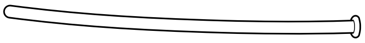
Select the appropriate probe for the patient. Using adult probes on premature infants and children may injure the mucous membrane.

Reusable Probes

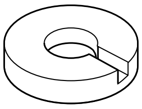
Thermistor Probe	Purpose
YSI-401JG* 	For adult rectum/esophagus
YSI-402JG* 	For child rectum/esophagus
YSI-409JG* 	For body surface

* These thermistor probes are available direct from YSI, Yellow Springs Instrument CO., Inc., Yellow Springs Ohio 45387, USA; Phone +1 513-767-7241.

YSI-401JG comes with a probe cover**.



YSI-409JG comes with an insulation pad**.



** These parts have not been checked for compliance with the MDD (Medical Device Directive). For EC member countries, Nihon Kohden recommends the use of parts that comply with MDD.

Disposable Probe

The following probes can be used on this monitor. To use the disposable probes, 5-15801 extension cable is required.

The disposable probes and the extension cable are available direct from Kendall Healthcare Products Company (www.kendallhq.com) or their suppliers.

CAUTION

Do not reuse disposable probes on other patients.

Disposable Probe		Thickness	Purpose
Sonatemp	5-13212**	12F	For esophagus
	5-13218**	18F	
	5-13224**	24F	
Sheritemp	5-15610**	18F	For esophagus/rectum
Sheritemp	5-16201**	—	For body surface
Sheritemp	5-26101**		For tympanic membrane
Foley catheter	5-18808**	8F	For bladder
	5-18810**	10F	
	5-18812**	12F	
	5-18814**	14F	
	5-18816**	16F	
	5-18818**	18F	

** These parts have not been checked for compliance with the MDD (Medical Device Directive). For EC member countries, Nihon Kohden recommends the use of parts that comply with MDD.

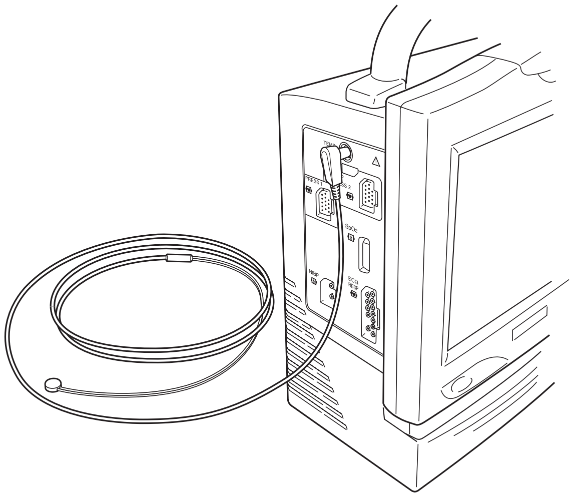
Connecting Cables and Attaching the Probe

Connecting Cable to the Monitor

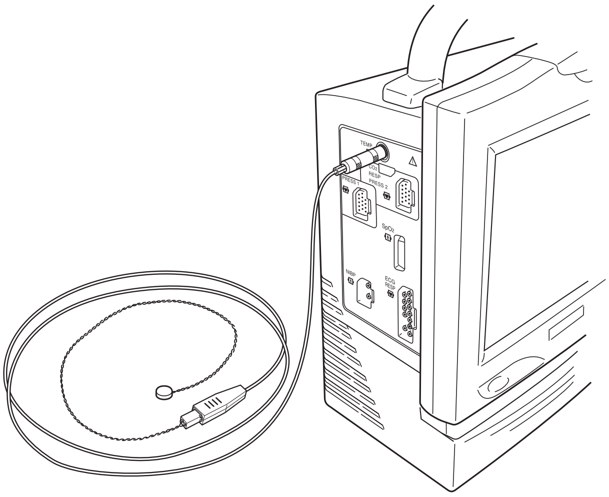
Connect the probe cord to the TEMP socket on the monitor.

When using a disposable probe, connect the extension cable between the probe and the TEMP socket.

Connecting the YSI-409JG reusable probe for the body surface


PRESS 1
PRESS 2
SpO2
NIBP
ECG
RESP

Connecting the disposable probe (Sheritemp body surface:5-16201)


TEMP
CO2
RESP
PRESS 1
PRESS 2
SpO2
NIBP
ECG
RESP

Attaching the Probe to the Patient

CAUTION

Select the appropriate probe for the patient. Using adult probes on premature infants and children may injure the mucous membrane.

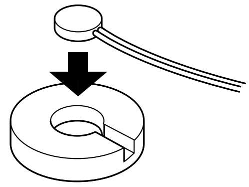
NOTE

For details on how to attach the probe, refer to the probe instruction manual.

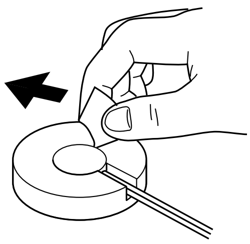
Attaching Probe to the Body Surface

CAUTION

The insulation pad may irritate the skin. In long term monitoring, change the attachment site.

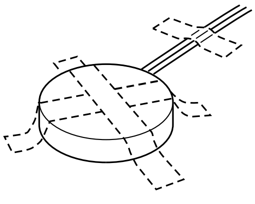


1. Put the sensor probe on the insulation pad.



2. Remove the backing paper from the insulation pad.

3. Attach the probe to the patient.



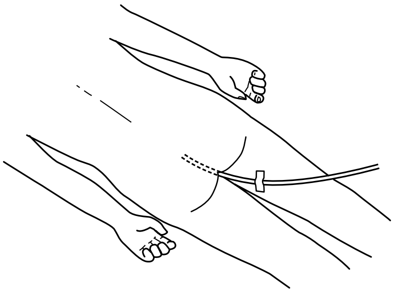
To measure the peripheral temperature, attach the probe to the ankle or palm. If the patient sweats heavily or moves violently, fasten the pad with surgical tape.

Using the insulation pad

The pad prevents the environmental temperature from affecting the sensor temperature and also prevents internal body heat from escaping at the attached site so that a stable temperature is obtained.

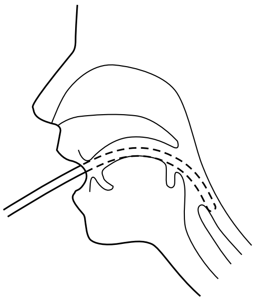
NOTE

When the measuring site is exposed directly to air, the temperature may be lower than normal. It takes about 20 to 30 minutes to reach the equilibrium temperature after attaching the sensor.



Inserting the Probe into the Rectum

1. Attach the probe cover to the tip of the probe for the rectum. If you have no probe cover, apply lubricating agent on the tip of the probe.
2. Insert the probe 3 to 7 cm into the rectum.
3. Fasten the probe cable to the skin using surgical tape.



Inserting the Probe into the Esophagus

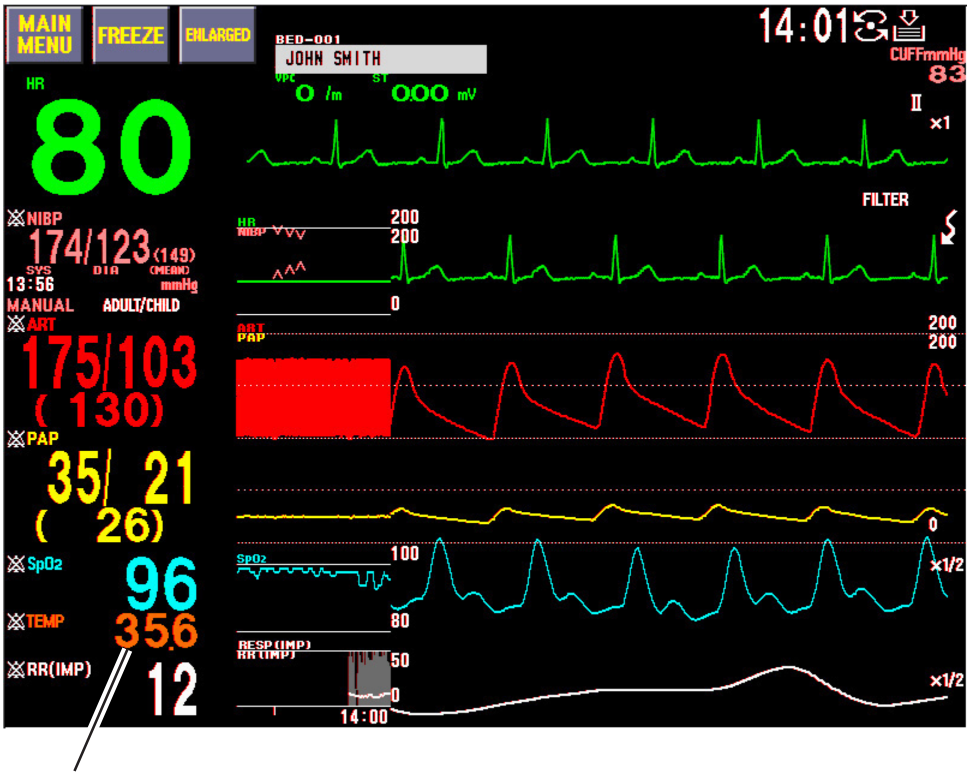
Insert the probe for the esophagus into the esophagus through the nostrils or mouth.
For adults, insert 22 to 26 cm from the incisor teeth.

Monitoring Temperature

After completing the preparation, temperature data appears on the screen.

For error messages and monitoring problems, refer to Section 17.

Temperature Information on the Monitoring Screen


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
14:01
CUFFmmHg
83
VPC
0 /m
ST
0.00 mV
II
×1
HR
80
FILTER
NIBP
174/123 (149)
SYS DIA (MEAN)
mmHg
13:56
MANUAL
ADULT/CHILD
HR
NIBP
200
200
0
ART
175/103
(130)
ART
PAP
200
200
PAP
35/ 21
(26)
0
SpO2
96
SpO2
100
80
×1/2
TEMP
35.6
RESP (IMP)
RR (IMP)
50
0
14:00
×1/2
RR(IMP)
12

Temperature

Changing Temperature Settings

NOTE

To change settings for monitoring temperature, the temperature probe must be connected to the TEMP socket.

Change settings on the TEMP window. The temperature alarm limits can be changed.

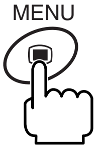
The temperature unit can be set to °C or °F on the SYSTEM SETUP screen. Refer to Section 3.

Changing the Temperature Alarm Limits

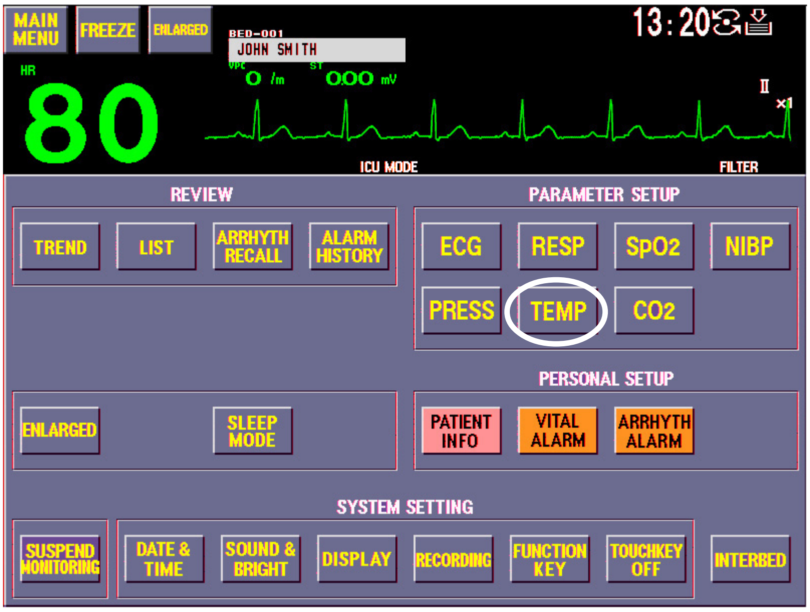
CAUTION

When the upper or lower alarm limit is turned off, there will be no temperature upper or lower alarm for that limit.

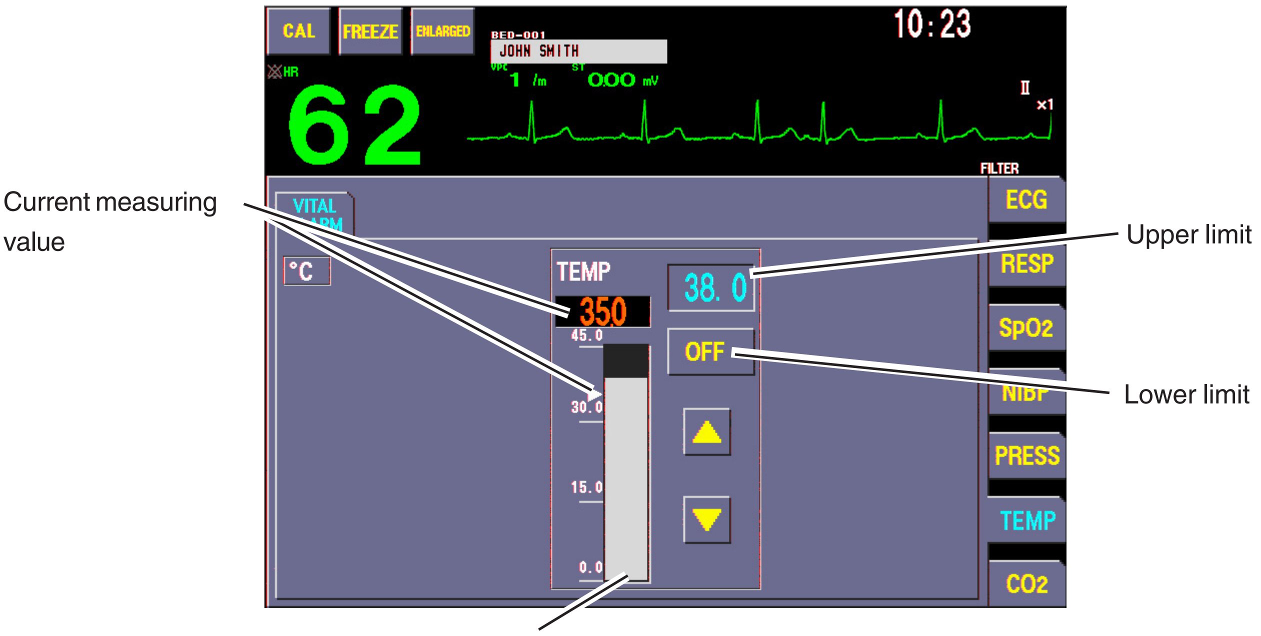
You can set the upper and lower temperature alarm limits on this window. Other alarm items must be set on the VITAL ALARM window. You can set all alarms, including the upper and lower temperature alarm limits, on the VITAL ALARM window (See Section 6).



1. Press the MENU key on the front panel to display the MENU window.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC
0 /m
ST
0.00 mV
II
×1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

2. Touch the “TEMP” key. The TEMP window appears.

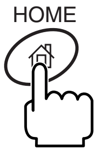

CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
10:23
HR
62
VPC 1 /m
ST 0.00 mV
II
×1
FILTER
VITAL ALARM
°C
TEMP
350
45.0
30.0
15.0
0.0
38.0
OFF
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
Current measuring value
Upper limit
Lower limit

Temperature alarm setting bar

3. Touch the upper limit box to set the upper limit or touch the lower limit box to set the lower limit.

4. Touch the desired level on the setting bar. Touch the ▲ or ▼ key to adjust the setting.

   If the upper limit is set to a value above the maximum or the lower limit is set to a value below the minimum, the alarm is set to OFF.



5. Press the HOME key on the front panel to return to the monitoring screen.

Section 17 Error Messages and Troubleshooting

Monitoring 17.1
    Messages 17.1
    Problems 17.2
Network 17.3
    Messages 17.3
    Problems 17.4
Recording (When Using an Optional Recorder Module) 17.5
    Messages 17.5
    Problems 17.5
Printing 17.6
    Messages 17.6
    Problems 17.6
ECG Monitoring 17.7
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    Problems 17.8
Respiration Monitoring 17.9
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    Problems in Impedance Method 17.9
    Problems in Thermistor Method 17.10
SpO_2 Monitoring 17.11
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    Problems 17.12
NIBP Monitoring 17.13
    Messages 17.13
    Problems 17.14
IBP Monitoring 17.15
    Messages 17.15
    Problems 17.15
Temperature Monitoring 17.16
    Messages 17.16
    Problems 17.16
CO_2 Monitoring 17.17
    Messages 17.17
    Problems 17.17

Monitoring

Messages

Screen Message	Possible Cause/Criteria	Action
XXXX ALARM	Alarm concerning the XXXX (parameter name) occurred.	Press the HOME key to display the monitoring screen. Check the error message. Perform the countermeasure referring to the parameter error message section.
ALARM bed name	Alarm occurred on an interbed bed.	Check the data of the interbed bed on the INTERBED window and remove the cause.
ALARM SILENCED	The SILENCE ALARMS key was pressed to silence the alarm.	• When the alarmed cause is resolved, the alarm is cleared. • When the SILENCE ALARMS key is pressed during alarm suspension, all alarms are resumed.
ALARMS SUSPENDED	The SILENCE ALARMS key is pressed before alarm occurrence. The alarm is suspended for the displayed time.	To cancel alarm suspension, press the SILENCE ALARMS key again.
ALL ALARMS OFF	The “SUSPEND MONITORING” key, “BYPASS” key or “ALL ALARMS OFF” key is touched to suspend alarm function.	To resume alarm function, touch the “SUSPEND MONITORING”, “BYPASS” or “ALL ALARMS OFF” key.
BATTERY WEAK	Battery is fully discharged.	Replace the battery with a fully charged battery or use AC power.
CALIBRATING	The “CAL” key on the screen was touched.	Release the “CAL” key when calibration is not necessary.
CONNECTOR OFF	The connection cord of the monitoring parameter is disconnected from the monitor.	Connect the connection cord properly. When monitoring the parameter of the disconnected cord is not necessary, press the SILENCE ALARMS key to silence the alarm.
	The connection cord is damaged.	Replace the connection cord with a new one.
DIFFERENT ALARM SILENCED	Another alarm occurred during alarm silence and the SILENCE ALARMS key was pressed to silence that alarm.	• When the alarmed cause is resolved, the alarm is cleared. • When the SILENCE ALARMS key is pressed during alarm suspension, all alarms are resumed.
FREEZE	The waveforms are frozen.	To unfreeze the waveforms: • Touch any key on the screen • Press any key on the front panel • The waveforms are unfreezed 3 minutes after freezing
MPU FAILURE	Socket on the monitor is damaged.	Contact your Nihon Kohden distributor.
MPU MODULE ERROR	Monitor failure.	Contact your Nihon Kohden distributor.
PARAMETER DUPLICATED	More than the specified number of channels are used for a parameter.	Only use the specified number of channels.
PARAMETER NOT AVAILABLE	The connection cord of the parameter which cannot be monitored on this monitor is connected to the multi-parameter socket.	Only IBP, respiration in thermistor method and CO_2 can be monitored by connecting the connection cord to the multi-parameter socket.
	The connection cord of a parameter other than IBP is connected to the PRESS1 socket. (On BSM-2304 only)	Only IBP can be monitored by connecting the connection cord to the PRESS1 socket.
TOUCH KEY OFF	The touch screen key function is turned off.	To enable the touch screen keys: • Press any key on the front panel • The touch screen key function resumes 3 minutes after disabling the touch screen key function

Problems

Trouble	Possible Cause/Criteria	Action
The screen is dark.	The brightness of the screen is not appropriate.	Adjust the setting on the SOUND & BRIGHT window. Refer to Section 4.
	The backlight is old.	Contact your Nihon Kohden distributor.
	The monitor is operating on battery.	If necessary, set POWER SAVING MODE on the SYSTEM SETUP screen to OFF.
No sync sound.	The sync sound setting is turned OFF.	Set the sync sound to ON on the SOUND & BRIGHT window. Refer to Section 4.
	The sync sound volume is turned down.	Adjust the volume setting on the SOUND & BRIGHT window. Refer to Section 4.
	The sleep mode is turned on.	The sleep mode is turned off when: • The touch screen is touched • Key on the front panel is pressed
The time displayed on the upper right corner of the screen is not correct.	The date and time setting is not correct.	Set the correct date and time on the DATE & TIME window. Refer to Section 4.
	The backup battery is old.	Check the date and time setting on the DATE & TIME window and turn off and on the power of the monitor. If the time is incorrect, replace the battery with a new one. Contact your Nihon Kohden distributor.
The monitor is too hot.	The vent hole is obstructed.	Remove the cause.
The touch screen keys do not function.	The pressed position and activated position do not match.	Calibrate the touch screen. Refer to Section 18.
The monitor only operates for about 2 hours with a fully charged battery.	The battery pack is old.	Replace the battery pack with a fully charged new one.
Some part of the review data is deleted or the time is incorrect.	The monitor is turned off during the system check screen display.	The remaining data may not be reliable. Delete all data.

Network

Messages

Screen Message	Possible Cause/Criteria	Action
INSERT NETWORK CARD	The QI-101P network card or QI-111P network printer card is removed from the monitor.	Insert the QI-101P network card or QI-111P network printer card into the monitor properly. When not connecting the monitor to a network, press the SILENCE ALARMS key to silence the alarm.
INVALID CARD	A card other than QI-101P network card or QI-111P network printer card is inserted.	Only the QI-101P network card or QI-111P network printer card can be on the monitor.
NETWORK CARD ERROR	The QI-101P network card or QI-111P network printer card failure.	Contact your Nihon Kohden distributor.
🔄	• The monitor is connected to a central monitor and is sending waveform(s) to the central monitor. Or • The monitor is connected to a network and is monitored by another bedside monitor with the interbed function. Check that the monitor data are properly monitored on the receiving instrument. It takes about one minute for this icon to disappear after all the receiving instruments are turned off or all the receiving instruments stop monitoring this monitor with the interbed function.	—
🖨	The QI-111P network printer card is inserted into the monitor.	—

Problems

Trouble	Possible Cause/Criteria	Action
The monitor cannot be connected to the network (the ⇄ icon or 🖶 icon does not appear on the screen).	The network card or network printer card is not inserted into the monitor properly.	Insert the network card or network printer card into the monitor properly. Refer to Section 2.
	The network cable is not connected to the network card or network printer card properly.	Connect the network cable to the network card or network printer card properly. Refer to Section 2.
	The network settings are not correct.	Set the correct network settings on the NETWORK SETUP or PRINTER SETUP of the SYSTEM SETUP screen. Refer to Section 3.
The monitor cannot be connected to the network (the ⇄ icon does not appear on the screen).	The monitor is not selected as a monitored bed on the central monitor or receiving instrument.	Select the monitor as a monitored bed on the central monitor or receiving instrument.
	Discontinuity in the network cable or faulty hub.	Replace the network cable or the hub with a new one.
	The connector on the network card is damaged.	Contact your Nihon Kohden distributor.
The patient name which is entered on the FREE window disappeared.	When the monitor is connected to the network, the FREE window is not available. The patient name entered from the FREE window is deleted when the monitor is connected to the network.	Enter the patient name on the KEYBOARD window.
The FREE window of the PATIENT INFO window cannot be displayed.		When the monitor does not need to be connected to the network, remove the network card from the monitor.

Recording (When Using an Optional Recorder Module)

Messages

Screen Message	Possible Cause/Criteria	Action
CLOSE PAPER MAGAZINE	The recorder door is open.	Push the recorder door closed until it clicks.
INSERT REC PAPER	No recording paper.	Load the recording paper. Refer to Section 2.
	The recording paper is not loaded correctly.	Correctly load the recording paper. Refer to Section 2.
	Data is recorded.	To stop recording, press the record key on the recorder module.

Problems

Trouble	Possible Cause/Criteria	Action
There is no recording (only paper feeding).	The recording paper is upside down.	Reload the recording paper into the paper magazine correctly. Refer to Section 2.
Waveforms can be recorded but the trend and list recording cannot.	Dust in the sensor inside the paper magazine.	Clean the surface of the sensor inside the paper magazine with a dry cotton swab. Refer to Section 18.
Recording is faint.	The specified paper is not used.	Use the FQW50-3-100 recording paper.
	The thermal head is dirty.	Clean the thermal head with the provided thermal head cleaning pen. Refer to Section 18.
Dots are missing.	The thermal head is dirty.	Clean the thermal head with the provided thermal head cleaning pen. Refer to Section 18.
Recording suddenly starts without key operation.	Alarm recording or periodic recording mode is set to ON.	Set the alarm recording or periodic recording mode on the RECORDING window to OFF if not needed. Press the record key on the recorder module to stop recording.
No paper is feeding.	The recorder door is open.	Push the recorder door closed until it clicks.
	Dust may have collected in the gears.	Contact your Nihon Kohden distributor.
Recorder operates only some of the time.	Dust in the sensor inside the paper magazine.	Clean the surface of the sensor inside the magazine with a dry cotton swab.

Printing

Messages

Screen Message	Possible Cause/Criteria	Action
CANNOT PRINT	Too many print commands are sent to the network printer.	Insert the QI-101P network card or QI-111P network printer card into the monitor properly. When not connecting the monitor to a network, press the SILENCE ALARMS key to silence the alarm.
	The network cable is not properly connected to the QI-111P network printer card.	Properly connect the network cable to the network printer card.
	Printer settings are not correct.	Correctly set the printer setting on the PRINTER SETUP on the SYSTEM SETUP screen. Refer to Section 3.
	The recording paper is not loaded correctly.	Correctly load the recording paper. Refer to Section 2.
PRINTING 🖨	Data is sent to the network printer.	—

Problems

Screen Message	Possible Cause/Criteria	Action
The monitor cannot be connected to the network (the 🖨 icon does not appear on the screen).	The network printer card is not inserted into the monitor properly.	Insert the network printer card into the monitor properly. Refer to Section 2.
	The network cable is not connected to the network printer card properly.	Connect the network cable to the network printer card properly. Refer to the Section 2.
	The printer settings are not correct.	Set the correct printer settings on the PRINTER SETUP of the SYSTEM STUP screen. Refer to Section 3.
The monitor’s data cannot be printed on the network printer.	The QI-101P network card is inserted in the monitor.	Use the QI-111P network printer card to connect the monitor to the network printer.

ECG Monitoring

Messages

Screen Message	Possible Cause/Criteria	Action
ARRHYTHMIA ANALYSIS OFF	ARRHYTHMIA ANALYSIS on the ECG window is set to OFF.	If arrhythmia analysis is necessary, set ARRHYTHMIA ANALYSIS on the ECG window to ON.
ATTACH ELECTRODES	The monitor is in STANDBY MODE and waiting for the electrodes to be attached to the patient.	Attach electrodes to the patient.
AUTO LEAD CHANGE	AUTO LEAD CHANGE on the ECG window is set to ON, an electrode of the lead for the first trace was detached for more than 5 seconds and therefore the lead was changed to a stable lead.	Check the electrode attachment.
CHECK ELECTRODES	The electrode lead is detached from the electrode.	Connect the electrode lead to the electrode firmly.
	The electrode cannot be attached firmly to the skin.	Replace the electrode with a new one.
	The electrode lead is disconnected from the ECG connection cord.	Connect the electrode lead to the ECG connection cord.
	The contact between the lead and electrode is poor.	Clean the electrode lead clip or replace the electrode lead with a new one.
	The CABLE/LEADS setting on the ECG window is not correct.	Set the correct setting for the CABLE/LEADS.
	The electrode lead is damaged.	Replace the electrode lead with a new one.
	Differential offset voltage at electrodes.	Replace the electrode with a new one.
LEARNING	Started learning QRS for arrhythmia analysis.	Wait for the learning to complete.
NOISE	The baseline is not stable due to respiration or body movement.	Change the electrode position.
	EMG noise is superimposed.	Change the electrode position to where there is less muscle.
	The electrode is pulled by the lead.	Put some slack into the electrode lead.
	The electrode is dry.	Replace the electrode with a new one.
	The contact between the lead and electrode is poor.	Clean the electrode lead clip or replace the electrode lead with a new one.
	High electrode impedance.	Rub the skin with “skinPure” skin preparation gel.
	An electric blanket is used.	Use another warming method.
	Equipment which emits strong electromagnetic interference is nearby. e.g. ESU, cellular phone.	Keep the interference source away from the monitor or turn off the emitter source power. When using the ESU, refer to “Use with an Electrosurgical Unit” in Section 10.
	Equipotential grounding is not acquired.	Connect the equipotential ground terminal on the monitor to the equipotential ground terminal on the wall with the grounding lead.
PACING (This message appears only when PACING DETECTION is set to ON on the ECG window.)	Pacing spike is detected.	When the patient does not have an implanted cardiac pacemaker, set the DETECTION to OFF on the ECG window.
	An electric blanket is used.	Use another warming method.
	ECG of a neonate is monitored.	Set the DETECTION to OFF on the ECG window.

Problems

Trouble	Possible Cause/Criteria	Action
The heart rate is inaccurate.	The QRS amplitude is small.	Change the sensitivity so that the QRS amplitude is larger than 1 cm.
	The QRS is not detected correctly.	Change to a lead which provides good QRS.
		Change the lead or electrode position so that the QRS is large and T wave is small.
	The PACING DETECTION setting on the ECG window is not appropriate.	When the patient does not have an implanted cardiac pacemaker or neonate's ECG is monitored, set the DETECTION to OFF.
The arrhythmia alarm occurs frequently when heart rate is normal.	The dominant QRS is not appropriate for arrhythmia monitoring.	Re-learn the patient ECG or change the dominant QRS.
	Patient moved or EMG noise is superimposed.	Change the electrode position to where there is less muscle.
ECG waveform does not appear on the screen when electrodes are attached properly.	The CABLE/LEADS setting on the ECG window is not correct.	Set the correct setting for the CABLE/LEADS.
AC interference on the ECG waveform.	An electrical blanket is used.	Use another warming method or place a shield cover around the electrical blanket.
	The electrode is dry.	Replace the electrode with a new one.
	FILTERS on the ECG window is set to OFF.	Set FILTERS to ON.
Baseline wandering.	The baseline is not stable due to respiration or body movement.	Change the electrode position to where there is less muscle.
	The electrode is dry.	Replace the electrode with a new one.
	The contact resistance between the skin and electrode is high.	Rub the skin with “skinPure” skin preparation gel.
	FILTERS on the ECG window is set to OFF.	Set FILTERS to ON.

Respiration Monitoring

Messages

Screen Message	Possible Cause/Criteria	Action
APNEA	Apnea exceeded the apnea alarm limit.	————
CONNECTOR OFF (Thermistor)	The respiration pickup is disconnected from the multi-parameter socket.	Connect the respiration pickup properly. When respiration monitoring is not necessary, press the SILENCE ALARMS key to silence the alarm.
RESP OFF (Impedance)	IMP RESP MEASURE on the RESP window is set to OFF.	When monitoring respiration by impedance method is necessary, set IMP RESP MEASURE to ON.
CHECK SENSOR (Thermistor)	The respiration pickup is damaged.	Replace the respiration pickup with a new one.

Problems in Impedance Method

Trouble	Possible Cause/Criteria	Action
The respiration data is not displayed on the screen.	IMP RESP MEASURE on the RESP window is set to OFF.	Set IMP RESP MEASURE to ON.
	Electrodes, electrode leads, ECG connection cord are not connected correctly.	Connect them properly.
	The electrode is dry.	Replace the electrode with a new one.
	The skin-electrode contact impedance is high.	Reduce the impedance by using “skinPure” skin preparation gel.
The respiration waveform and respiration rate are not stable.	The electrode positions are not appropriate for measuring respiration.	Check the attached position of the electrodes.
	The electrode is dry.	Replace the electrode with a new one.
	NOISE REDUCTION ON IMPEDANCE RESP is set to OFF and the respiration waveform amplitude is too small.	Change the sensitivity so that the amplitude is larger than 10 mm.
	NOISE REDUCTION ON IMPEDANCE RESP is set to ON and the timing of the respiration and heart rate coincide.	Set NOISE REDUCTION ON IMPEDANCE RESP to OFF on the SYSTEM SETUP screen.

Problems in Thermistor Method

Trouble	Possible Cause/Criteria	Action
The respiration data is not displayed on the screen.	Malfunction of the respiration pickup.	Replace the respiration pickup with a new one.
	The respiration pickup is connected to the PRESS1 socket. (On BSM-2304 only)	Connect the respiration pickup to the multi-parameter socket.
The amplitude of the respiration waveform is small or becomes a baseline.	When measuring at the nostrils, the position of the respiration pickup is not appropriate.	Attach the respiration pickup to a position where sufficient temperature changes can be seen.
	The respiration pickup for nose is used for measuring a patient with trachea tube inserted.	Measure with a respiration pickup for airway.
	The temperature difference between inspiration and expiration is small due to increase in temperature of the inspired air.	Use the impedance method.
The expiration and inspiration phases are reversed.	The inspiration temperature is higher than the expiration temperature.	Use the impedance method.
The respiration rate is not accurate.	NOISE REDUCTION ON IMPEDANCE RESP is set to OFF and the respiration waveform amplitude is too small.	Change the sensitivity so that the amplitude is larger than 10 mm.
	NOISE REDUCTION ON IMPEDANCE RESP is set to ON.	Set NOISE REDUCTION ON IMPEDANCE RESP to OFF on the SYSTEM SETUP screen.

SpO_2 Monitoring

Messages

Screen Message	Possible Cause/Criteria	Action
ATTACH PROBE	The monitor is in STANDBY MODE and waiting for the probe to be attached to the patient.	Attach the probe to the patient.
CANNOT DETECT PULSE	The pulse waveform is not stable and SpO_2 value cannot be measured.	Attach the probe to the patient properly.
CHANGE PROBE	Probe is expired.	Replace the probe with a new one.
	Probe is damaged or short-circuited.	Replace the probe with a new one.
	SpO_2 connection cord is damaged.	Replace the SpO_2 connection cord with a new one.
CHECK PROBE	The probe cable is disconnected from the SpO_2 connection cord.	Connect the probe cable to the SpO_2 connection cord. If SpO_2 monitoring is not necessary, press the SILENCE ALARMS key.
	The probe is not attached to the patient properly.	Attach the probe to the patient properly.
CHECK PROBE SITE	The probe is not attached at the appropriate site.	Attach the probe to a site 6 to 14 mm thick.
	The probe has expired.	Replace the probe with a new one.
CONNECTOR OFF	The SpO_2 connection cord is disconnected from the SpO_2 socket.	Connect the SpO_2 connection cord properly. When SpO_2 monitoring is not necessary, press the SILENCE ALARMS key to silence the alarm.
DETECTING PULSE	Searching for the correct pulse wave.	Wait until the pulse wave is detected.
	The probe attachment site is not appropriate.	Attach the probe to an appropriate place.
	Poor blood circulation for measuring SpO_2.	Check the patient condition, probe attachment or change the attachment site.
	The probe is secured too tightly and it is obstructing the blood circulation.	Reattach the probe.
	The probe is disconnected from the SpO_2 connection cord.	Connect the probe to the SpO_2 connection cord.
	The finger probe is not attached to the patient properly.	Attach the finger probe firmly to the patient.
LIGHT INTERFERE	A surgical light, bilirubin lamp, or sunlight is close to the probe.	Cover the attachment site with a blanket.
▮	Considerable body movement.	When the message is displayed frequently, check the patient condition and, if necessary, change the attachment site.
	The probe is not attached to the patient properly.	
PROBE DISCONNECT	The probe is disconnected from the SpO_2 connection cord.	Connect the probe to the SpO_2 connection cord properly.
SpO2 MODULE ERROR	SpO_2 hardware malfunction.	Turn off the monitor power, wait for a few minutes and turn on the power again. If the message still appears, contact your Nihon Kohden distributor.
WEAK PULSE	Poor peripheral circulation.	Check the patient condition and change the attachment site.
	The probe is attached too tightly and is obstructing the blood circulation.	Reattach the probe.

Problems

Trouble	Possible Cause/Criteria	Action
Unstable SpO_2 value.	The probe size is inappropriate.	Use the correct size probe.
	The probe is attached to the same limb that is used for NIBP or IBP measurement.	Attach the probe to the other limb.
	An ESU is used.	Locate the ESU as far as possible from the probe and wait until the pulse wave stabilizes.
	Measuring on the venous pulse.	Cannot measure correctly.
SpO_2 value on the monitor and CO oximeter do not match.	The probe is not attached properly.	Attach the probe correctly. (The emitter and detector of the probe must face each other.)
	The attachment site is inappropriate.	Attach the probe to a site 6 to 14 mm thick.
	The measuring site is not clean.	If necessary, remove nail polish and clean the measuring site.
	Too much abnormal hemoglobin (HbCO, MetHB, etc.).	Cannot measure correctly.
	Dye (methylene blue or indocyanine green) is injected in the blood.	Cannot measure correctly.
	Measuring during CPR.	Cannot measure correctly.
Probe is damaged.	Probe is disinfected by an unspecified procedure.	Disinfect the probe using the specified method.
	The probe is repeatedly used.	Replace the probe with a new one when the expiration date passes.
Sine wave noise on the pulse wave	Light interference.	Cover the attachment site with a blanket.
	The line frequency setting on the monitor is not correct.	Set the correct line frequency on the monitor.

NIBP Monitoring

Messages

Screen Message	Possible Cause/Criteria	Action
AIR LEAK	The cuff pressure does not change after inflation even after a certain period of time.	Connect the cuff to the air hose properly.
		Connect the air hose to the socket properly.
	The cuff or air hose is damaged.	Replace the cuff or air hose with a new one.
CANNOT DETECT PULSE	The patient's pulse wave is small.	Measure by palpation or the invasive blood pressure method.
	The cuff is not wrapped to the patient correctly.	Wrap the cuff around the arm of the patient properly.
CONNECTOR OFF	The air hose is disconnected from the NIBP socket.	Connect the air hose properly. When NIBP monitoring is not necessary, press the SILENCE ALARMS key to silence the alarm.
CUFF OCCLUSION	The cuff pressure does not decrease after measurement has completed.	Check that the air hose is not bent or squeezed.
HIGH CUFF PRESS	Enormous pressure was applied by the pressure of the cuff.	When measuring an adult, ask the patient not to move too much.
INFLATION PRESS LOW	Insufficient cuff inflation pressure.	Wait until the cuff pressure rises.
MEAS TIME-OUT	The measuring time exceeded the specified time due to arrhythmia or noise.	If the cause is arrhythmia, measure by invasive blood pressure measurement. Remove the cause if due to noise.
NIBP MODE CHANGED	Cuff type is changed.	Check that the correct cuff type is used.
NIBP MODULE ERROR	Module malfunction.	Contact your Nihon Kohden distributor.
NIBP SAFETY CIRCUIT RUNNING (When this message is displayed, measurement cannot be performed for 40 seconds.)	The hose is bent	Check that the hose is not bent.
	The inflation time is too long.	Stop measurement.
	In auto mode measurement, the cuff inflation started before the cuff deflation is complete.	Stop measurement.
PLEASE WAIT	Measurement started before the cuff inflation pressure was deflated enough.	Check the cuff pressure before starting measurements. When measuring using the adult cuff: below 12 mmHg When measuring using the cuff for neonates: below 3 mmHg
REMEASURING (Remeasurement is automatically performed. If the message still appears, after remeasurement, do the counter actions.)	The cuff is not attached to the patient.	Attach the cuff to the patient.
	Patient moved during measurement.	Wait for the patient to stop moving, then measure again.
	Patient's pulse is too small.	Measure by palpation or the invasive blood pressure method.
	The cuff is not attached properly.	Attach the cuff properly.
	The cuff size is not appropriate.	Check that the cuff of the correct size is used.
	Patient's pulse and heart rate is unstable.	Wait for the patient to relax and stop moving.
SYSTOLIC OVER	The maximum blood pressure exceeded 290 mmHg when using the adult cuff, or 125 mmHg when using the neonate cuff.	Measure by palpation or the invasive blood pressure method.
WEAK PULSE	The patient's pulse wave is too small.	Measure by palpation or the invasive-blood pressure method.
	The cuff is wrapped too loosely.	Wrap the cuff around the arm properly.
	The cuff size is inappropriate.	Use the appropriate cuff.
ZERO CALIBRATING	NIBP zero balance adjustment is being performed.	Do not touch the cuff during zeroing and wait for the message to disappear.

Problems

Trouble	Possible Cause/Criteria	Action
Cuff inflation pressure is less than 10 mmHg.	The cuff hose is not connected to the cuff socket properly.	Connect the cuff hose to the socket properly.
	The cuff is not wrapped around the arm or is wrapped too loosely.	Wrap the cuff around the upper arm.
The cuff does not inflate when the NIBP START/STOP key is pressed.	The cuff hose is not connected to the cuff socket.	Connect the cuff hose to the socket firmly.
	The cuff hose or air hose may be folded or squeezed when the cuff pressure display on the screen increases quickly but the actual cuff does not inflate.	Check the cuff hose and air hose.
Abnormal measurement results are displayed.	The cuff size is not correct.	Select the cuff which fits the patient's limb circumference.
	The cuff is not wrapped around the arm correctly.	Wrap the cuff around the upper arm, not too tightly or too loosely.
	NIBP data is not correct because of body movement.	Prevent the patient from moving during measurement.
	Measurement on the wrong site.	Measure NIBP at the correct site.
The cuff is suddenly deflated during inflation.	The NIBP START/STOP key is pressed during inflation.	——
Auto measurement does not start even when the time interval has passed.	The time interval for the NIBP auto measurement is set incorrectly.	Set the correct time interval.
The cuff suddenly inflates.	The measurement mode is set to auto mode.	Check the time interval.
	NIBP measurement is triggered by PWTT.	Set PWTT to OFF on the NIBP window when NIBP measurement with PWTT is not necessary.
Cannot connect cuff to the air hose.	Unspecified cuff is used.	Use a cuff specified by Nihon Kohden.
Cannot measure NIBP.	Noise which disables calculation of the blood pressure has interfered.	Remove the cause.
	The pulse wave is unstable due to arrhythmia.	Ask the patient not to move too much and perform invasive blood pressure measurement as required.
	The air hose is bent or squeezed.	Remove the cause.
	The cuff has worn out.	Use a new cuff.
Blood congestion occurs.	Measuring over a long period of time at intervals less than 2.5 minutes.	Increase the measuring interval.
		Do not measure NIBP over a long time.
Thrombus occurs.	Measuring a sickle anemia patient.	Do not perform NIBP measurement on a sickle anemia patient.
NIBP data on the screen is dark.	The time set at OLD NIBP AFTER on the SYSTEM SETUP screen elapsed from the last measurement.	When NIBP is measured again, the data is displayed in normal brightness.

IBP Monitoring

Messages

Screen Message	Possible Cause/Criteria	Action
CHECK SENSOR	The blood pressure transducer is disconnected from the IBP connection cord.	Connect the blood pressure transducer to the IBP connection cord properly.
	Malfunction of the blood pressure transducer.	Replace the blood pressure transducer with a new one.
	The IBP connection cord is damaged.	Replace the IBP connection cord with a new one.
CONNECTOR OFF	The IBP connection cord is disconnected from the multi-parameter socket.	Connect the IBP connection cord properly. When IBP monitoring is not necessary, press the SILENCE ALARMS key to silence the alarm.
OUT OF RANGE	The measured value is outside the measuring range.	Check the measuring environment.
	Malfunction of the blood pressure transducer.	Replace the blood pressure transducer with a new one.
ZEROING COMPLETE	Zero balance adjustment is complete.	IBP monitoring is available.
ZERO CALIBRATING	Zero balance adjustment is complete.	Wait for the zero balance adjustment to complete.
ZERO IMBALANCE	Zero balance is not adjusted.	Adjust the zero balance.
ZERO OUT OF RANGE	Malfunction of the blood pressure transducer.	Replace the blood pressure transducer with a new one.
	Monitor malfunction.	Contact your Nihon Kohden distributor.
ZERO UNSTABLE	The circuit is not exposed to air during zero balance adjustment.	Expose the circuit to air and perform zero balance adjustment again.
	The pressure of zero balance is unstable.	Re-connect the circuit and perform zero balance adjustment again.

Problems

Trouble	Possible Cause/Criteria	Action
The acquired blood pressure value is different from the estimated value.	Air bubbles remain in the circuit.	Remove the air bubbles.
	An extra tube is connected in the circuit.	Remove the extra tube.
	The position of the blood pressure transducer is inappropriate.	Check the position of the blood pressure transducer.
	A blood pressure transducer with different sensitivities is used.	Check the blood pressure transducer.
	Other causes.	Perform zero balance adjustment again.
No invasive blood pressure value appears on the screen.	The measurement is out of range.	Check the measuring condition.
	The blood pressure transducer is damaged.	Replace the blood pressure transducer with a new one.
There is no sync sound when SYNC SOURCE is set to P1. (On BSM-2304 only)	The multi-parameter socket is used for monitoring IBP.	Use the PRESS1 socket for monitoring IBP when you want to set P1 as the sync source.

Temperature Monitoring

Messages

Screen Message	Possible Cause/Criteria	Action
ATTACH SENSOR	The monitor is in STANDBY MODE and waiting for the sensor to be attached to the patient.	Attach the sensor to the patient.
CHECK TEMP SENSOR	The probe is disconnected from the TEMP socket.	Connect the probe to the TEMP socket properly.
	The temperature probe is damaged.	Replace the temperature probe with a new one.
	The measured value is outside the measuring range.	Check the probe attachment site.
CONNECTOR OFF	The temperature probe is disconnected from the TEMP socket.	Connect the probe properly. When temperature monitoring is not necessary, press the SILENCE ALARMS key to silence the alarm.

Problems

Trouble	Possible Cause/Criteria	Action
The temperature value is not displayed on the screen.	The temperature probe is faulty.	Replace the temperature probe with a new one.
	Monitor malfunction.	Contact your Nihon Kohden distributor.

CO_2 Monitoring

Messages

Screen Message	Possible Cause/Criteria	Action
APNEA	Apnea exceeded the apnea alarm limit.	――――――
CAL?? (when using TG-950P CO_2 sensor kit)	Zero calibration is not performed.	Perform zero calibration.
CHANGE ADAPTER	The CO_2 adapter is damaged.	Replace the CO_2 adapter with a new one.
CHANGE SENSOR	The CO_2 sensor is damaged.	Replace the CO_2 sensor with a new one.
CHECK SENSOR	Insufficient sensor light.	Refer to the CO_2 sensor kit manual. If necessary, replace the kit with a new one.
CONNECTOR OFF	The CO_2 sensor kit is disconnected from the multi-parameter socket.	Connect the CO_2 sensor kit properly. When CO_2 monitoring is not necessary, press the SILENCE ALARMS key to silence the alarm.

Problems

When Using TG-900P/TG-920P CO_2 Sensor Kit

Trouble	Possible Cause/Criteria	Action
The CO_2 data is not displayed on the screen.	The CO_2 sensor kit is connected to the PRESS1 socket. (On BSM-2304 only)	Connect the CO_2 sensor kit to the multi-parameter socket.
The measured value is low.	CO_2 is mixed in the inspiration.	Refer to the “Measurement Error” section.
	The airway adapter/nasal adapter is dirty.	Replace the adapter with a new one.
	The measurement is performed where atmospheric pressure is low, such as at high altitude.	Consider the atmospheric pressure when making evaluation.
The measured value is high (error is about 8 mmHg).	Anesthetic gas is used. O_2: 4 L/min, N_2O: 2 L/min, sevoflurane: 1%	Set the correct inspired gas composition.
The measured value is inaccurate.	Oscillation.	Check the respirator and remove the cause.
	Currently doing suctioning.	After completing suction, wait for at least 20 seconds, then detect the inspiration again and correct the error.
	A Jackson Rees respiration circuit or Mapleson D respiration circuit is connected to the patient. (TG-900P only)	Cannot measure correctly.
	The respiration rate of the patient is very high or respiration is irregular.	Cannot measure correctly.
The respiration waveform does not appear.	Oscillation.	Check the respirator and remove the cause.
	The airway adapter/nasal adapter is disconnected from the CO_2 sensor kit.	Connect the adapter to the CO_2 sensor kit.
The red LED on the CO_2 adapter blinks.	CO_2 sensor or CO_2 adapter is faulty.	Replace the CO_2 sensor or CO_2 adapter with a new one.
	Apnea for longer than 20 s.	The red LED blinks when apnea is longer than 20 s regardless of the alarm setting on the monitor.

When Using TG-950P CO_2 Sensor Kit

Problem	Probable Causes	Action
The CO_2 data is not displayed on the screen.	The CO_2 sensor kit is connected to the PRESS1 socket. (On BSM-2304 only)	Connect the CO_2 sensor kit to the multi-parameter socket.
The measured value is low.	Zero calibration is not performed.	Calibrate the airway adapter.
	The airway adapter is dirty.	Replace the airway adapter with a new one.
The measured value is inaccurate.	Oscillation.	Check the respirator and remove the cause.
	The respiration rate of the patient is very high or respiration is irregular.	Cannot measure correctly.
The respiration waveform does not appear.	The airway adapter is disconnected from the CO_2 sensor kit.	Connect the airway adapter to the CO_2 sensor kit.

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This section explains how to clean and care for your monitor to ensure reliability and many years of excellent operating condition. Cleaning and disinfecting probes, sensors and cables are also explained in this section.

CAUTION

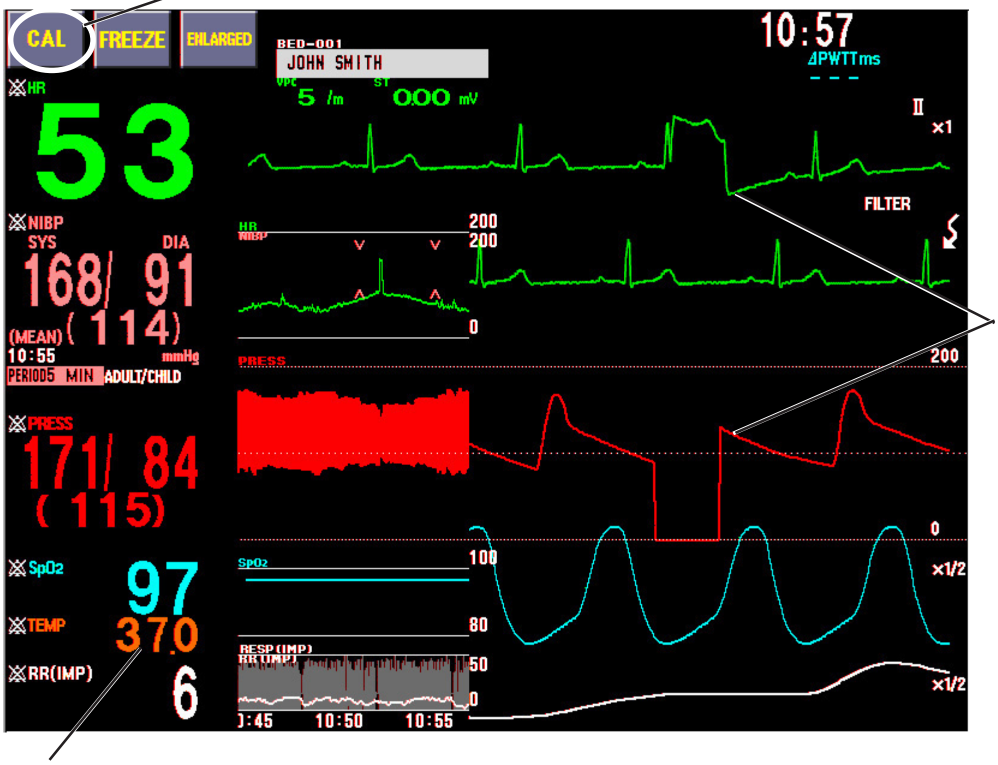
- **Do not disassemble the monitor. Disassembly must be performed by a qualified service personnel.**
- **Fuses should be replaced by qualified service personnel.**

Calibrating Waveforms

To check accuracy, you can display a calibrated ECG and blood pressure waveforms and 37°C temperature. During calibration, the calibrated waveforms are displayed. Visually verify that they are correct.

To perform calibration, the calibration function must be assigned to one of the function keys in the upper left corner of the screen. Refer to “Assigning a Function to the Function Keys” in Section 4.

When the calibration function is assigned to a function key, calibration is performed any time by touching the “CAL” key. The “CALIBRATING” message appears on the screen.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
10:57
ΔPWTTms
HR
53
VPC 5 /m
ST 0.00 mV
II
×1
FILTER
NIBP
SYS
DIA
168/ 91
(MEAN) (114)
10:55
mmHg
PERIOD5 MIN
ADULT/CHILD
HR
NIBP
200
200
0
PRESS
200
PRESS
171/ 84
(115)
0
SpO2
97
SpO2
100
×1/2
80
TEMP
37.0
RESP(IMP)
RR(IMP)
50
0
RR(IMP)
6
×1/2
):45
10:50
10:55

Cal function key

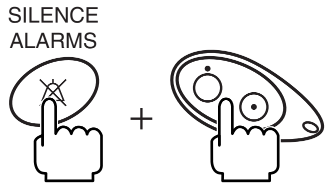
Calibrated waveforms

Temperature

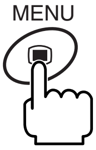
Calibrating the Touch Screen

Calibrate the touch screen when the pressed position and the activated position do not match.

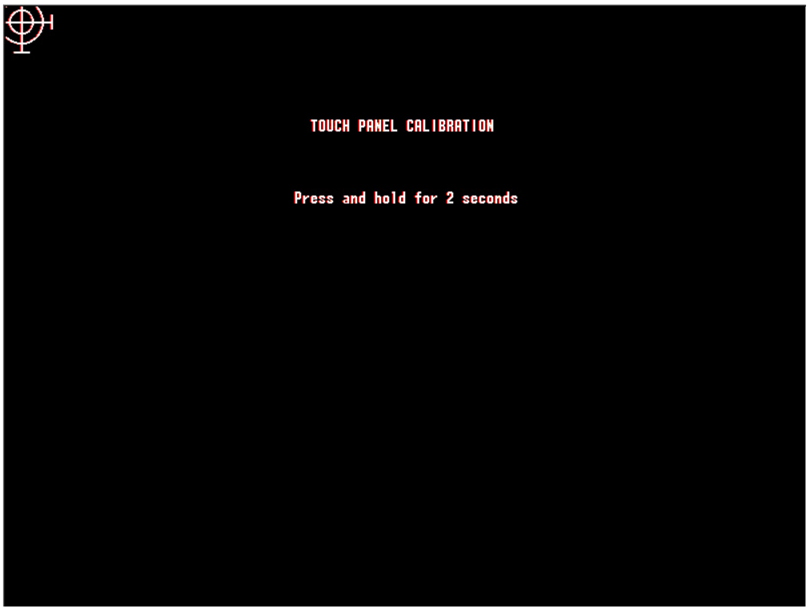
1. Turn the monitor power off.



2. Press the power switch while pressing the SILENCE ALARMS key on the front panel until the DIAGNOSTIC CHECK screen is displayed.



3. Press the MENU key on the front panel. The TOUCH PANEL CALIBRATION screen appears.



TOUCH PANEL CALIBRATION

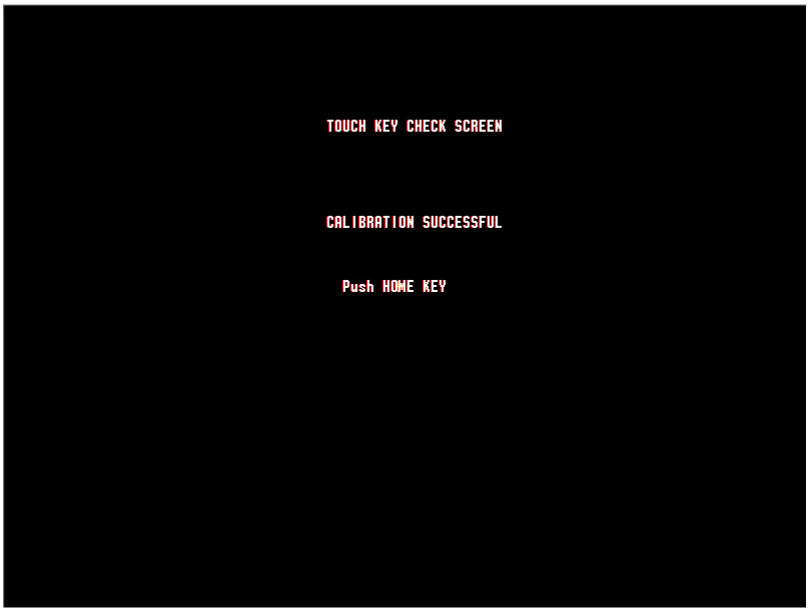
Press and hold for 2 seconds

4. Touch the exact center of the mark for more than 2 seconds. When the mark is correctly touched, the mark appears on another place. The mark appears in 9 places.

   When all the 9 places are touched correctly, the “CALIBRATION SUCCESSFUL” message appears.

NOTE

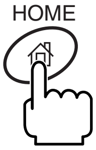
Make sure to touch the exact center of every mark and check that the “CALIBRATION SUCCESSFUL” message appears on the screen. If the touch screen calibration is interrupted, the pressed position and the activated position do not match. If this occurs, calibrate the touch screen again.



TOUCH KEY CHECK SCREEN

CALIBRATION SUCCESSFUL

Push HOME KEY

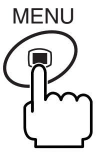


5. Press the HOME key on the front panel to display the DIAGNOSTIC CHECK screen.

6. Touch the “MONITOR MODE” key on the DIAGNOSTIC CHECK screen to display the monitoring screen.

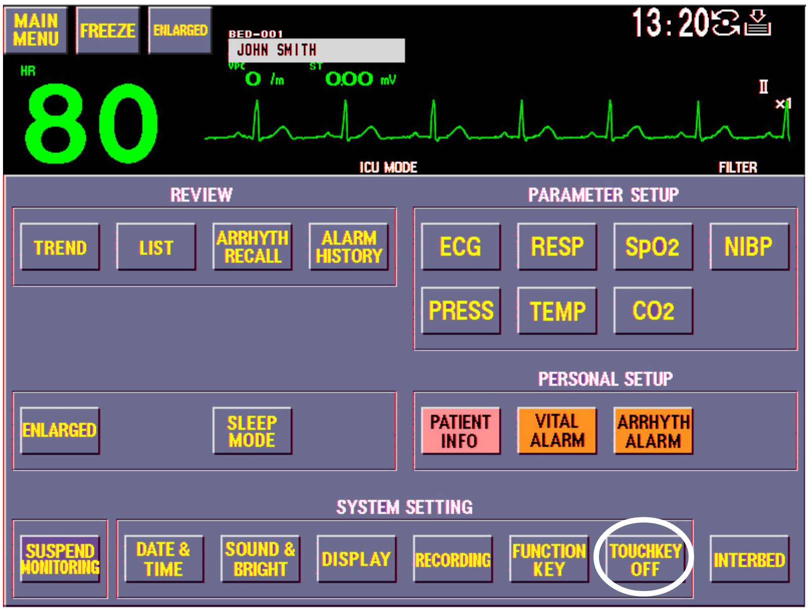
Cleaning the Touch Screen

When cleaning the touch screen during monitoring, turn the touch key function off before cleaning. The touch key function is turned off for 3 minutes or until it is turned on again.

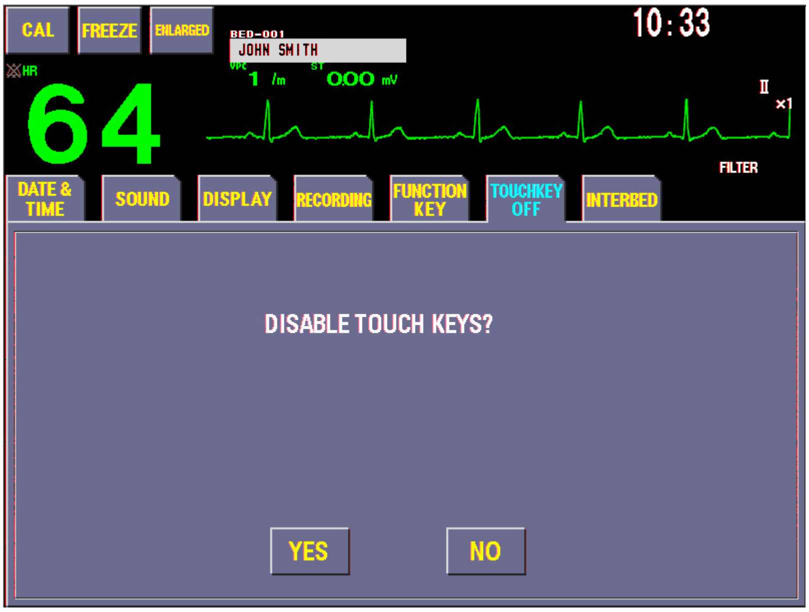


Turning Touch Key Function On or Off

1. Press the MENU key on the front panel to display the MENU window.


MAIN MENU
FREEZE
ENLARGED
BED-001
JOHN SMITH
13:20
HR
80
VPC 0 /m
ST 0.00 mV
II
×1
ICU MODE
FILTER
REVIEW
TREND
LIST
ARRHYTH RECALL
ALARM HISTORY
PARAMETER SETUP
ECG
RESP
SpO2
NIBP
PRESS
TEMP
CO2
PERSONAL SETUP
ENLARGED
SLEEP MODE
PATIENT INFO
VITAL ALARM
ARRHYTH ALARM
SYSTEM SETTING
SUSPEND MONITORING
DATE & TIME
SOUND & BRIGHT
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED

2. Touch the “TOUCHKEY OFF” key to display the TOUCHKEY OFF window.


CAL
FREEZE
ENLARGED
BED-001
JOHN SMITH
10:33
HR
64
VPC 1 /m
ST 0.00 mV
II
×1
FILTER
DATE & TIME
SOUND
DISPLAY
RECORDING
FUNCTION KEY
TOUCHKEY OFF
INTERBED
YES
NO

DISABLE TOUCH KEYS?

3. Touch the “YES” key to turn the touch key function off.

   Touch the “NO” key to not turn the touch key function off.

To turn on the touch key function on again, do one of the following.

- Press the SILENCE ALARMS key
- Press the MENU key
- Press the HOME key
- Press the record key (when using the optional recorder module)

Cleaning the Touch Screen

NOTE

- **Do not use a dry or rough cloth.**
- **Do not use acidic, alkaline detergents or alcohol other than ethanol or isopropyl.**

Clean the touch screen using a dry soft cloth or a cloth which is moistened with neutral detergent and wrung out.

Handling Accessories After Use

Battery Pack

Battery Lifetime

The battery pack can be used for about 200 cycles of full discharging/charging.

Replacing Battery Pack

Replace the battery pack with a new one after 200 cycles of discharging/charging or after one year whichever comes first.

Replacement should be performed by a qualified service personnel.

Disposal of Battery Pack

Before disposing of the battery, check with your local solid waste officials for details in your area for recycling options or proper disposal. The battery is recycleable. At the end of its useful life, under various state and local laws, it may be illegal to dispose of this battery into the municipal waste stream.

ECG and Respiration in Impedance Method

Electrode

For handling the electrodes, refer to the electrode manual.

Disposing of Electrodes

Follow your local laws for disposing of medical waste.

Cleaning and Disinfecting the Electrode Lead and ECG Connection Cord

NOTE

- **Do not touch the connector pin.**
- **Do not wet the connector.**

Cleaning

Wipe the electrode lead and ECG connection cord with a soft cloth moistened with neutral soap, water or alcohol and wipe with a dry cloth or gauze.

Disinfecting

To disinfect the electrode lead and ECG connection cord, wipe them with a non-abrasive cloth moistened with any of the disinfectants listed below. Use the recommended concentration.

Disinfectant	Concentration (%)
Chlorohexidine gluconate solution	0.5
Benzethonium chloride solution	0.2
Glutaraldehyde solution	2.0
Benzalkonium chloride	0.2
Hydrochloric alkyldiaminoethylglycine	0.5

Respiration in Thermistor Method

Cleaning and Disinfecting the Respiration Pickup

CAUTION

- **The respiration pickup is not waterproof. Do not immerse it directly into chemical liquids or water.**
- **Cover the yellow connector of the respiration pickup with a polyethylene bag.**
- **Never autoclave the respiration pickup.**
- **The sterilizing temperature must not exceed 65°C (149°F) because the respiration pickup may deform or melt above this temperature.**

NOTE

Do not let any liquid contact the connector.

Wipe the respiration pickup with a soft cloth moistened with water and neutral detergent or disinfecting alcohol.

SpO$_2$

NOTE

For details, refer to the probe manual.

Expiration of Nihon Kohden Disposable Probes

CAUTION

- **Do not use the probe over its stated lifetime. Otherwise the SpO$_2$ measurement accuracy cannot be guaranteed.**
- **Do not use disposable probes for other patients. If the probe is dirty with blood or bodily fluids, replace it with a new one.**

Replace the probe with a new one every 96 hours when using a TL-251T/252T/253T disposable probe or 32 hours when using a TL-260T multi-site Y disposable probe. Otherwise, accurate measurement cannot be continued. If the probe is dirty with blood or bodily fluids, replace the probe with a new one.

Disposing of Probes

Follow your local laws for disposing of medical waste.

Cleaning and Disinfecting the SpO$_2$ Connection Cord

NOTE

- **Do not touch the connector pins.**
- **Do not wet the connector.**

Cleaning

Wipe the SpO$_2$ connection cord with a soft cloth moistened with neutral soap, water or alcohol and wipe with a dry cloth or gauze.

Disinfecting

To disinfect the SpO$_2$ connection cord, wipe it with a non-abrasive cloth moistened with any of the disinfectants listed below. Use the recommended concentration.

Disinfectant	Concentration (%)
Chlorohexidine gluconate solution	0.5
Benzethonium chloride solution	0.2
Glutaraldehyde solution	2.0
Benzalkonium chloride	0.2
Hydrochloric alkyldiaminoethylglycine	0.5

NIBP

CAUTION

- **Follow the instruction manual of the cuffs and hoses.**
- **Do not wet the connector.**
- **For Nihon Kohden cuffs and hoses, the sterilizer temperature must not exceed 65°C (149°F) because the cuff or hose may deform or melt above this temperature.**

NIBP Cuff Lifetime

Replace the NIBP cuff one year after you start using it. The lifetime of the rubber cuff is approximately 30,000 inflations.

Cleaning and Disinfecting the YP-950T/951T/952T/953T/954T/955T/960T/961T/962T/963T/964T/965T Reusable Cuffs

CAUTION

- **Do not autoclave.**
- **Use only glutaraldehyde solution.**
- **Never allow liquid to get inside the rubber cuff.**
- **Do not sterilize or disinfect the cuff with ultraviolet light or ozone.**

Cleaning

To clean the cuff, carefully pull out the rubber cuff from the cloth cover.

Cloth cover: Wash with neutral detergent and water. Thoroughly dry it.

Rubber cuff: Wipe with a soft cloth or cotton moistened with disinfecting alcohol. Thoroughly dry it.

Disinfecting

To disinfect the cuff, use glutaraldehyde solution. Use the disinfectant of the recommended concentration. Refer to the disinfectant manual for details. After disinfection, clean the cuff as described above.

Cleaning and Disinfecting the Air Hose and Extension Hose

CAUTION

Do not soak the tip of the hose in water. Otherwise, water gets into the hose and correct measurement data cannot be obtained.

NOTE

Do not let any liquid contact the connector.

Cleaning

To clean the hoses, wipe them with a soft cloth moistened with neutral detergent and approx. 40°C (104°F) warm water.

Disinfecting

To disinfect the hoses, wipe them with a soft cloth moistened with either of the disinfectants listed below. Follow the disinfectant instruction and use the recommended concentration.

Disinfectant
Chlorohexidine gluconate solution
Hydrochloric alkyldiaminoethylglycine

Disinfecting the Disposable Cuffs

CAUTION

- **Do not sterilize or disinfect the non-sterilized disposable cuffs for neonates.**
- **Do not reuse disposable cuffs.**

To disinfect disposable cuffs before use, refer to “Disinfecting Disposable Cuffs before Use” in Section 13.

The disposable cuffs for adults, children and infants can be sterilized. To sterilize these cuffs, use glutaraldehyde solution by following its instructions.

Disposal of Cuffs

Follow your local laws for disposing of medical waste.

IBP

The procedure described in this section is a typical maintenance procedure.

For details, refer to the instruction manual for each part.

Cleaning, Disinfecting, Sterilizing and Storing the Blood Pressure Transducer

CAUTION

- **Never put a pressure transducer in a steam autoclave, because moisture will damage the internal mechanism.**
- **When the dome is removed from the transducer, do not apply force to the exposed sensing diaphragm.**
- **Do not scrape or scrub the diaphragm to remove blood.**
- **When immersing the transducer in a sterilizing solution with other instruments or when storing the transducer after use, protect the transducer diaphragm with a dome or protective cap.**
- **Do not re-use a disposable transducer.**

When using a dome without a membrane, disinfect and sterilize according to the following procedure.

Cleaning the Blood Pressure Transducer

Wash the blood pressure transducer and dome separately with water.

NOTE

- **Do not wet the connector of the blood pressure transducer.**
- **When removing the dome from the blood pressure transducer, be careful not to touch the diaphragm.**

Disinfecting and Storing the Blood Pressure Transducer

CAUTION

- **Check the cables before soaking them in solution. If the cable sheath is damaged, the solution will soak into the cable and transducer and cause transducer corrosion and decrease the isolation.**
- **Do not wet the connector at the end of the transducer cable when washing the transducer.**
- **When immersing with other devices in the chemical solution, attach the dome or cap to the blood pressure transducer to protect the diaphragm.**
- **Do not soak the transducer with dome in the disinfectant.**

---

1. Wash the transducer and dome with water and soak in any of the following chemical solutions.

Type	Main ingredient	Dilution	Dipping time	Post-treatment
For surgical instruments	Detergicide®	750 times	30 minutes or more	Soak in 4000 times diluted solution
	Benzalkonium Chloride	100 times	10 minutes	Dry after washing
	Benzethonium Chloride	100 times	10 minutes	Dry after washing
For clinical instruments	Glutaraldehyde (Sterihyde®)	2W/V%	1 hour or more	Dry after washing
	Glutaraldehyde (Cidex®)	2.25W/V%	1 hour or more	Dry after washing

2. After disinfecting, rinse the transducer and dome thoroughly with sterilized water, and wipe off with a clean dry gauze.

3. Loosely attach the dome to the transducer.

CAUTION

Tightening the dome to the transducer can damage the dome.

---

4. Wrap the transducer with a 20 cm square clean gauze loosely, and wrap it again with sterilized cloth.

5. Loosely wind the cord around the sterilized cloth.

6. Store in a dry and clean place.

NOTE

To protect the diaphragm, store with the dome or cap attached.

Sterilizing and Storing the Blood Pressure Transducer

CAUTION

- **Do not sterilize the transducer by boiling, heating, or autoclaving.**
- **The sterilizing temperature must not exceed 65°C (149°F). Otherwise the transducer may deform above this temperature.**
- **Do not touch the diaphragm when removing the dome from the transducer.**
- **Do not rub the diaphragm to remove blood.**

1. Cover the cleaned and dried transducer connector with a polyethylene bag and tie with a rubber band.

2. Loosely secure the dome on the transducer and wind the cord in a large circle and place it inside the EOG sterilization bag.

CAUTION

- **The dome may be damaged by sterilization if clamped too tight.**
- **Do not bend the cords. Make as large a loop of cord as possible for easy ventilation of air from inside the transducer and protection from damage which may be caused by rapid pressure changes during gas sterilization.**

3. Sterilize the transducer and dome with ethylene oxide gas (EOG).

4. Remove the gas from the EOG sterilization bag and store the blood pressure transducer in the EOG sterilization bag in an appropriate place.

NOTE

To protect the diaphragm, store with the dome or cap attached.

5. After using EOG, ventilate the air thoroughly.

Disposing of Transducer and Dome

Follow your local laws for disposing of medical waste.

Cleaning and Disinfecting the IBP Connection Cord

CAUTION

- **Do not immerse the connector in any liquid, because this may damage the connector wiring and the liquid may get inside the connector.**
- **A break in the plastic covering may cause the solution to get inside the cable, and damage the transducer.**
- **The IBP connection cord connector has a memory chip. Do not let any liquid contact the connector and do not touch the connector pins.**

To clean the IBP connection cord, wipe it with a soft cloth moistened with neutral detergent and approx. 40°C (104°F) warm water.

To disinfect the IBP connection cord, wipe it with a soft cloth moistened with any of the disinfectants listed below. Use the recommended concentration.

Disinfectant	Concentration (%)
Chlorohexidine gluconate solution	0.5
Benzethonium chloride solution	0.2
Glutaraldehyde solution	2.0
Benzalkonium chloride	0.2
Hydrochloric alkyldiaminoethylglycine	0.5

Temperature

Cleaning, Disinfecting and Sterilizing the Reusable Probe

NOTE

Refer to the probe instruction manual for details on maintenance.

Disposal of Disposable Probe

Follow your local laws for disposing of medical waste.

CO_2

NOTE

Refer to the CO_2 sensor kit and airway adapter/nasal adapter manual.

Cleaning and Disinfecting the Monitor

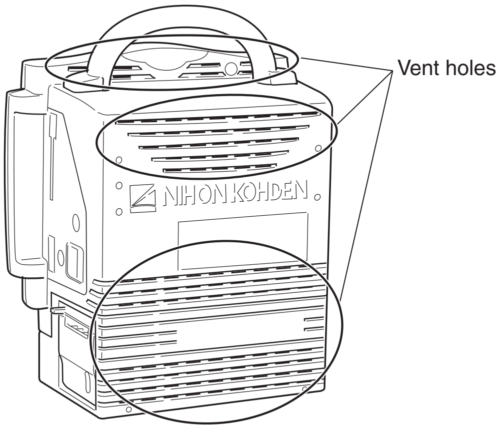
CAUTION

- **Do not use volatile liquids such as thinner or benzine, because these will cause the materials to melt or crack.**
- **Before cleaning the monitor, turn the monitor power off and disconnect the power cord from the AC SOURCE power cord socket on the right side panel.**
- **After cleaning, make sure that the monitor is completely dried.**
- **Wipe the monitor thoroughly after disinfecting it with spray.**
- **The monitor is not waterproof. Be careful not to let any water get inside the monitor.**
- **Never sterilize the monitor because the materials may deform, crack or discolor.**

Cleaning

Clean the surface of the monitor every month with a soft cloth moistened with neutral soap, water or alcohol (76.9 to 81.4%), and wipe with a dry cloth or gauze.

Remove dust from the vent holes on the panels with a cotton swab.



Disinfecting

To disinfect the outside surface of the monitor, wipe it with a non-abrasive cloth moistened with any of the disinfectants listed below. Use the recommended concentration.

Disinfectant	Concentration (%)
Chlorohexidine gluconate solution	0.5
Benzethonium chloride solution	0.2
Glutaraldehyde solution	2.0
Benzalkonium chloride	0.2
Hydrochloric alkyldiaminoethylglycine	0.5

Cleaning the Recorder Module

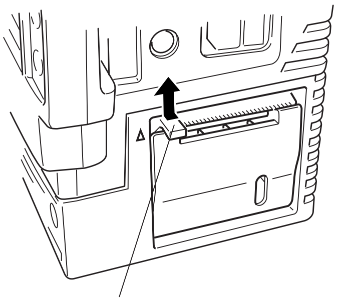
CAUTION

- **Do not touch the head with any hard object. When the head is tapped with a hard object, the head may crack and the heater element wire may break.**
- **Clean the head surface with the provided head cleaner pen before loading new paper. After a period of usage, paper dust may come between the paper and the head surface and good printing cannot be obtained.**
- **Be careful not to cut yourself with the paper cutter on the recorder.**

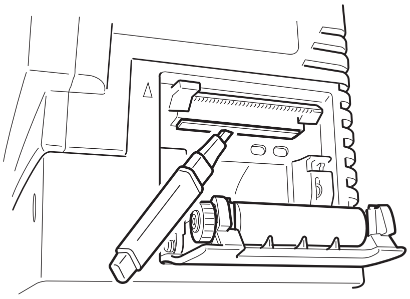
Cleaning the Thermal Head

To protect the thermal head from abrasion or damage and assure optimum performance and long service life, clean the surface of the head with the provided thermal head cleaning pen after every 7 to 10 sets of recording paper.

1. Turn off the monitor before cleaning the thermal head.
2. Push up the recorder door release lever and open the recorder door.



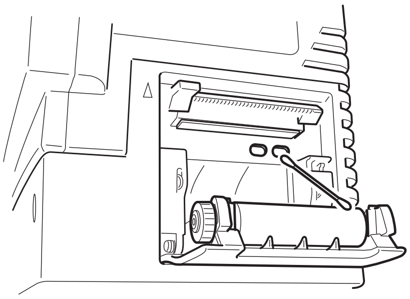
3. Clean the gold-colored part of the thermal head with the thermal head cleaning pen.



Cleaning the Sensors

The paper empty sensor and mark sensors are located as shown at the left.

Clean the sensor surfaces with a cotton swab.



Yearly Inspection

Check the following items every year to keep your monitor in optimal condition.

- Monitor is not dirty, damaged or rusty.
- No key or switch is broken.
- No damage to the sockets on the monitor.
- Power cord is not damaged.
- Grounding lead is properly connected.
- Screen is clean.
- Screen brightness can be adjusted.
- Screen display is correct.
- Clock is correct.
- SYSTEM SETUP settings are correct.
- The specified electrodes, sensors, transducers and probes are used.
- Recorder module operates properly when used.
- The specified recording paper is used.
- The recorded date is correct.
- Alarm and sync sound can be heard clearly.
- Alarm setting is correct and functions properly.
- Alarm indicator lamps light.
- The sync sound is produced and sync mark is displayed.
- There is no air leak from the NIBP cuff and air hose.
- The blood pressure zero balance is performed.
- The blood pressure label is attached to the connection cord connector.
- The correct values are obtained for invasive blood pressure and CO_2 in the calibration by the specified mercury manometer and calibration gas.
- No current leakage.
- Supplied voltage is correct.
- Measurement accuracy is within the specified range.
- Only the specified parts are used.

Clock Accuracy

At an operating temperature of 25°C, the accuracy of the clock IC of this monitor is about ±2 min 40 s per month.

At the storage temperature of between –20 and 60°C, the accuracy of the clock IC of this monitor is about ±5 min per month.

Periodically check that the time in the upper right corner of the monitor screen is correct.

To change the time setting, refer to “Changing Date and Time” in Section 4.

NOTE

When the date or time is changed during monitoring, the date and time of all stored data is also changed and may not match the date and time on the printout.

When the monitor is connected to a network
The time on this monitor is automatically adjusted to match the time of the network as long as the monitor is connected to the network. The date and time on all monitors in the network are set to the same setting.

Periodical Replacement Schedule

To maintain the performance of the instrument, the following part must be periodically replaced.

NK Code No.	Description	Expected Life Span
616193	Backlight assembly for LCD unit of BSM-2301/2304	Approx. 50,000 hours or 5 years and 9 months or more of continuous operation
677955	Backlight assembly for LCD unit of BSM-2351	
481809 (Supply code: X208)	Lithium battery for clock operation backup	Approx. 6 years or more
611893	Battery cushion sponge	Approx. 3 years or more
6114-120416	Battery cushion sponge	Approx. 3 years or more
6114-053114C	Platen roller	Approx. 6 years or more
107002	Retainer ring	Must be replaced with a new one when the platen roller is replaced.
445074	Thermal array head	Approx. 250 stacks or more of the recording paper
445109C	Paper drive motor	Approx. 6,000 stacks or more of the recording paper

Repair Parts Availability Policy

Nihon Kohden Corporation (NKC) shall stock repair parts (parts necessary to maintain the performance of the instrument) for a period of 8 years from the date of delivery. In that period NKC or its authorized agents will repair the instrument. This period may be shorter than 8 years if the board or part necessary for the faulty section is not available.

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Factory Default Settings

This section shows the available settings. The factory default settings are underlined.

OK: Remains in memory even when the monitor power is turned off.
30 min: Remains in memory for at least 30 minutes after turning the monitor power off. After 30 minutes, the setting changes back to the default setting.
--: Returns to the default setting when the monitor power is turned off.

For the alarm settings, refer to the “VITAL ALARM Window” and “ARRHYTH ALARM Window” sections.

SYSTEM SETUP Screen

Refer to “List and Explanation of the SYSTEM SETUP Settings” in Section 3.

ECG Window

Items			Settings	Backup
ECG	SENSITIVITY		×1/4, ×1/2, AUTO, ×1, ×2, ×4	OK
	LEAD		I, II, III, aVR, aVL, aVF, V4, V5	
ECG2	SENSITIVITY		×1/4, ×1/2, AUTO, ×1, ×2, ×4	
	LEAD		I, II, III, aVR, aVL, aVF, V4, V5	
FREE LEAD	FREE LEAD a (Ca/Va)		V1, V2, V3, V4, V5, V6	
	FREE LEAD b (Cb/Vb)		V1, V2, V3, V4, V5, V6	
OTHER SETTING	CABLE/LEADS		NORMAL 3 INDIV, 4-6 INDIV	
	SYNC SOURCE		ECG, SpO2, P1	
	ARRHYTHMIA ANALYSIS		ON, OFF	
	HR DISPLAY MODE		AVERAGE ECG, INSTANT ECG	
	FILTERS		ON, OFF	
	PACING	DETECTION	ON, OFF (OR, ICU: ON NICU: OFF)	
		MARK	ON, OFF	
	AUTO LEAD CHANGE		ON, OFF	

RESP Window

Items		Settings	Backup
SENS/LEAD	SENSITIVITY	×1/4, ×1/2, ×1, ×2, ×4	OK
	IMP RESP LEAD	R-L, R-F	
OTHER SETTING	IMP RESP MEASURE	ON, OFF (OR: OFF ICU, NICU: ON)	
	RESP SWEEP SPEED	1 mm/s, 6 mm/s, or 25 or 50 mm/s (OR: 6 ICU: 25 NICU: 1)	

SpO$_2$ Window

Items		Settings	Backup
SENSITIVITY		×1/8, ×1/4, ×1/2, AUTO, ×1, ×2, ×4, ×8	OK
OTHER SETTING	SYNC SOURCE	ECG, SpO$_2$, P1	
	SYNC PITCH	FIXED, SpO$_2$, P1	
	RESPONSE	FAST, NORMAL, SLOW*	

* This setting is not available on BSM-2304.

NIBP Window

Items			Settings	Backup
INTERVAL/CUFF	MEASURE INTERVAL*		MANUAL, STAT, 2 min, 2.5 min, 5 min, 10 min, 15 min, 30 min, 1 hour, 2 hour, 4 hour, 8 hour	30 min
HARD KEY INTERVALS			MANUAL (fixed), STAT, 2 min, 2.5 min, 5 min, 10 min, 15 min, 30 min, 1 hour, 2 hour, 4 hour, 8 hour (OR: STAT, 2.5, 5, 10 min ICU: 5, 10, 30 min, 1 h NICU: 30 min, 1 h)	OK
PWTT**	PWTT		ON, OFF	
	TRIGGER TIME		0 to 30 ms, 15 ms	
OTHER SETTING	TARGET CUFF PRESSURE	Adult/Child	100 to 280 mmHg, 180 mmHg	---
			13.0 to 37.0 kPa, 24.0 kPa	
		Neonate	70 to 120 mmHg, 100 mmHg	
			9.0 to 16.0 kPa, 13.0 kPa	

* This setting remains in memory for 30 minutes after turning the monitor power off. After 30 minutes, the settings return to the NIBP interval master setting on the SYSTEM SETUP screen.

** This setting is not available on BSM-2304.

PRESS Window

Items		Settings	Backup
P1 SCALE/ZERO CAL P2* SCALE/ZERO CAL	SCALE	0-20, 0-50, 0-100, 0-160, 0-200, 0-300 mmHg (P1: ICU, OR 0-200 NICU 0-100 P2: 0-200)	OK
		0-4.0, 0-8.0, 0-16.0, 0-24.0, 0-32.0, 0-40.0 kPa (P1: ICU, OR 0-32.0 NICU 0-16.0 P2: 0-32.0)	
OTHER SETTING	SYNC SOURCE	ECG, SpO$_2$, P1	
	SYNC PITCH	FIXED, SpO$_2$, P1	
	WAVEFORM DISPLAY	COMMON, SEPARATE	
	CALCULATION METHOD	STANDARD, PEAK	
	NUMERIC DISPLAY	S/D(M), M	
LABEL		ART, ART-2*, RAD, DORS, AO, FEM, UA, UV, PAP, CVP, RAP, RVP, PRESS, PRESS-2*, ICP, ICP-2*	--

* P2 is not available on BSM-2301/2351.

CO_2 Window

Items		Settings	Backup
SCALE (TG-900P) CAL/WAVE (TG-950P)		0-20, 0-40, 0-80 mmHg	OK
		0-4.0, 0-6.0, 0-12.0 kPa	
GAS	GAS COMPOSITION	AIR, O_2+AIR, O_2+N_2O O_2: 18 to 100%, N_2: 0 to 100% O_2: 21, N_2: 79	
OTHER SETTING	RESP SWEEP SPEED	1 mm/s, 6 mm/s, or 25 or 50 mm/s (OR: 6 ICU: 25 NICU: 1)	

TREND Window

Items		Settings	Backup
PARAMETER		HR, PR, VPC, ST, RR, APNEA (F), APNEA (T), SpO_2, NIBP, P1, P2, TEMP, CO_2, EVENT, PWTT	OK
Trend time (ZOOM IN/OUT)		1 hour, 2 hours, 4 hours, 8 hours, 24 hours	
SCALE	HR/PR (beats/min)	0-100, 0-200, 0-300 (OR, ICU: 0-100 NICU: 0-200)	
	VPC (VPCs/min)	0-20, 0-50, 0-100, 0-300	
	ST (mV)	–0.2-+0.2, –0.5-+0.5, –1.0-+1.0, –2.0-+2.0	
	ST (mm)	–2.0-+2.0, –5-+5, –10-+10, –20-+20	
	RR (breaths/min)	0-50, 0-150 (OR, ICU: 0-50 NICU: 0-150)	
	APNEA (F) (counts/min)	0-6, 0-12	
	APNEA (T) (s)	0-60, 0-120, 0-180	
	SpO_2 (%)	0-100, 50-100, 80-100	
	NIBP (mmHg)	0-100, 0-200, 0-300 (OR, ICU: 0-200 NIBP: 0-100)	
	NIBP (kPa)	0-16.0, 0-32.0, 0-40.0 (OR, ICU: 0-32.0 NIBP: 0-16.0)	
	PWTT (msec)	100-400, 200-400, 100-300	
	P1/P2 (mmHg)	0-20, 0-50, 0-100, 0-160, 0-200, 0-300 (P1: ICU, OR 0-200 NICU 0-100 P2: 0-200)	
	P1/P2 (kPa)	0-4.0, 0-8.0, 0-16.0, 0-24.0, 0-32.0, 0-40.0 (P1: ICU, OR 0-32.0 NICU 0-16.0 P2: 0-32.0)	
	TEMP (°C)	34-40, 0-40, 20-40	
	TEMP (°F)	92-104, 20-120, 80-120	
	CO_2 (mmHg)	0-20, 0-40, 0-80	
	CO_2 (kPa)	0-4.0, 0-6.0, 0-12.0	
	EVENT	—	
APNEA INTERVAL (s)		5, 10, 15, 20, 25, 30, 35, 40	

The data on the TREND window remain in memory for 30 minutes after turning the monitor power off. After 30 minutes, the data is lost.

P2 is not available on BSM-2301/2351. PWTT is not available on BSM-2304.

LIST Window

Items		Settings	Backup
LIST PARAM	PERIODIC LIST PARAMETERS	HR, PR, VPC, ST, RR, SpO_2, P1, P2, TEMP, CO_2	OK
	NIBP LIST PARAMETERS	HR, PR, VPC, ST, RR, SpO_2, P1, P2, NIBP* (fixed), TEMP, CO_2	
	PERIODIC LIST SAMPLING INTERVAL (min)	1, 5, 15, 30, 60	

The data on the LIST screen remain in memory for 30 minutes after turning the monitor power off. After 30 minutes, the data is lost.

P2 is not available on BSM-2301/2351.

* NIBP data is only listed on the NIBP list screen. Refer to “LIST Window” in Section 7.

ARRHYTH RECALL
Window

Items	Setting	Backup
ARRHYTH ITEM	ASYSTOLE, VF, VT, VPC RUN, COUPLET, EARLY VPC, BIGEMINY, VPC, BRADYCARDIA, TACHYCARDIA	30 min

The data on the ARRHYTH RECALL window remain in memory for 30 minutes after turning the monitor power off. After 30 minutes, the data is lost.

The settings remain in memory for 30 minutes after turning the monitor power off. After 30 minutes, the settings return to the arrhythmia recall master settings on the SYSTEM SETUP screen.

VITAL ALARM Window

Items	Settings	Backup
HR/PR (beats/min)	Upper: 20 to 300, OFF (5 steps), OR, ICU: 140 NICU: 180 Lower: 15 to 295, OFF (5 steps), OR, ICU: 40 NICU: 80	30 min
ST (mV)	Upper: −1.99 to +2.00, OFF (0.01 steps), OFF Lower: −2.00 to +1.99, OFF (0.01 steps), OFF	
ST (mm)	Upper: −19.9 to +20.0, OFF (0.1 steps) , OFF Lower: −20.0 to +19.9, OFF (0.1 steps) , OFF	
RR (breaths/min)	Upper: 2 to 150, OFF (2 steps), OFF Lower: 0 to 148, OFF (2 steps), OFF	
APNEA (s)	5 to 40, OFF (5 steps), 20	
SpO_2 (%)	Upper: 51 to 100, OFF (1 steps), OFF Lower: 50 to 99, OFF (1 steps), 90	
TEMP (°C)	Upper: 0.1 to 45.0, OFF (0.1 steps), OR, ICU: 38.0 NICU: 39.0 Lower: 0 to 44.9, OFF (0.1 steps), OFF	
TEMP (°F)	Upper: 33 to 113, OFF (1 steps), OR, ICU: 100 NICU: 102 Lower: 32 to 112, OFF (1 step), OFF	
NIBP (mmHg)	Upper: 15 to 260, OFF (5 steps), SYS: adult/child 180, neonate 100, DIAS: OFF, MEAN: OFF Lower: 10 to 255, OFF (5 steps), SYS: adult/child 80, neonate 50, DIAS: OFF, MEAN: OFF	
NIBP (kPa)	Upper: 1.5 to 35.0, OFF (0.5 steps), SYS: adult/child 24.0, neonate 13.5 DIAS: OFF, MEAN: OFF Lower: 1.0 to 34.5, OFF (0.5 steps), SYS: adult/child 10.5, neonate 6.5 DIAS: OFF, MEAN: OFF	
P1/P2 (mmHg)	Upper: 2 to 300, OFF (2 steps), SYS: OFF, DIAS: OFF, MEAN: OFF Lower: 0 to 298, OFF (2 steps), P1 ICU, OR: SYS: 80, DIAS: OFF, MEAN: 60 NICU: SYS: 50, DIAS: OFF, MEAN: 30 P2 SYS: OFF, DIAS: OFF, MEAN: OFF	
P1/P2 (kPa)	Upper: 0.5 to 40.0, OFF (0.5 steps), SYS: OFF, DIAS: OFF, MEAN: OFF Lower: 0.0 to 39.5, OFF (0.5 steps), P1 ICU, OR: SYS: 10.5, DIAS: OFF, MEAN: 8.0 NICU: SYS: 6.5, DIAS: OFF, MEAN: 4.0 P2 SYS: OFF, DIAS: OFF, MEAN: OFF	
$EtCO_2$ (mmHg)	Upper: 2 to 99, OFF (1 steps), OFF Lower: 1 to 98, OFF (1 steps), OFF	
$EtCO_2$ (kPa)	Upper: 1.0 to 13.5, OFF (0.5 steps), OFF Lower: 0.5 to 13.0, OFF (0.5 steps), OFF	
$FiCO_2$ (mmHg)	Upper: 1 to 5, OFF (1 steps), OR: 3 ICU, NICU: OFF	
$FiCO_2$ (kPa)	Upper: 0.1 to 0.7, OFF (0.1 steps), OR: 0.5 ICU, NICU: OFF	

The settings remain in memory for 30 minutes after turning the monitor power off. After 30 minutes, the settings return to the vital alarm master settings on the SYSTEM SETUP screen.

P2 is not available on BSM-2301/2351.

ARRHYTH ALARM Window

Items	Settings	Backup
ASYSTOLE	ON (fixed), threshold 3 to 10 s OR, ICU: threshold 5 NICU: threshold 3	30 min
VF	ON (fixed)	
VT	ON (fixed)	
VPC RUN	ON, OFF threshold 3 to 8 VPCs OR, NICU: OFF ICU: ON threshold 3	
COUPLET	ON, OFF	
EARLY VPC	ON, OFF	
BIGEMINY	ON, OFF	
FREQ VPC	ON, OFF threshold 1 to 50 VPCs/min, 10	

The settings remain in memory for 30 minutes after turning the monitor power off. After 30 minutes, the settings return to the arrhythmia alarm master settings on the SYSTEM SETUP screen.

RECORDING Window

Items	Settings	Backup
ALARM RECORDING	ON, OFF	OK
PERIODIC REC INTERVAL (min)	OFF, FREE, 30, 60, 120, 5(OCRG), 15(OCRG), 30(PWTT)	
SECOND WAVE	ECG2, RESP, SpO_2, P1, P2, CO_2, OFF	
THIRD WAVE	ECG2, RESP, SpO_2, P1, P2, CO_2, OFF	
RECORDING SWEEP SPEED	25 mm/s, 50 mm/s	

P2 is not available on BSM-2301/2351.

DATE & TIME Window

Items	Settings	Backup
YEAR	2000 to 2099	OK
MONTH	1 to 12	
DAY	1 to 31	
HOUR	0 to 23	
MINUTE	0 to 59	

The date and time are backed up by a lithium battery. The battery life is about 10 years.

SOUND & BRIGHT Window

Items	Settings	Backup
SYNC SOUND	ON, OFF	OK
SYNC SOUND VOLUME	16 steps, 5	
ALARM SOUND VOLUME	10 steps, 6	
BRIGHTNESS	8 steps, 5	

DISPLAY Window

Items	Settings	Backup
TREND ON MONITORING SCREEN	NORMAL, PWTT, OCRG 1 cm/min, OCRG 3 cm/min, OFF OR, ICU: NORMAL NICU: OCRG 1 cm/min	OK
RESP SWEEP SPEED	1 mm/s, 6 mm/s, or 25 or 50 mm/s OR: 6 ICU: 25 NICU: 1	

FUNCTION KEY Window

Items	Settings	Backup
FUNCTION KEY 1	FREEZE, TOUCHKEY OFF, PRESS ALL ZERO, CAL, PRINT, SUSPEND MONITORING, BYPASS, MAIN MENU, HOME, SLEEP MODE, DELETE ALL, OCRG RECORD, PWTT RECORD, ENLARGED, TREND, LIST, ARRHYTH RECALL, ALARM HISTORY, INTERBED	OK
FUNCTION KEY 2	FREEZE, TOUCHKEY OFF, PRESS ALL ZERO, CAL, PRINT, SUSPEND MONITORING, BYPASS, MAIN MENU, HOME, SLEEP MODE, DELETE ALL, OCRG RECORD, PWTT RECORD, ENLARGED, TREND, LIST, ARRHYTH RECALL, ALARM HISTORY, INTERBED OR: LIST ICU: SLEEP NICU: ALARM HISTORY	
FUNCTION KEY 3	FREEZE, TOUCHKEY OFF, PRESS ALL ZERO, CAL, PRINT, SUSPEND MONITORING, BYPASS, MAIN MENU, HOME, SLEEP MODE, DELETE ALL, OCRG RECORD, PWTT RECORD, ENLARGED, TREND, LIST, ARRHYTH RECALL, ALARM HISTORY, INTERBED OR, ICU: PRESS ALL ZERO NICU: ENLARGED	

INTERBED Window

Items		Settings	Backup
SETTING	INTERBED ALARM	ON, OFF	OK

Specifications

Display

Display size:	BSM-2301/2304: 8.4 inch, TFT type color LCD BSM-2351: 10.4 inch, TFT type color LCD
Waveform display mode:	Non-fade moving or non-fade fixed
Viewing area:	BSM-2301/2304: 170.4 mm × 127.8 mm BSM-2351: 211.2 mm × 158.4 mm
Resolution:	800 × 600 dots
Maximum number of waveform trace:	BSM-2301/2351: 5 traces BSM-2304: 6 traces
Sweep speed:	25 mm/s, 50 mm/s (Respiration and CO_2 low speed: 1.56 mm/s, 6.25 mm/s)
Sweep width:	BSM-2301/2304: about 124 mm at 25 mm/s sweep speed BSM-2351: about 154 mm at 25 mm/s sweep speed
Waveform display color:	12
Numeric display color:	12
Waveform freeze:	Provided
Display waveforms:	ECG, respiration, IBP, SpO_2 pulse wave and CO_2
Numerical data display:	Heart rate, VPC rate, ST level, respiration rate, IBP (systolic, diastolic, mean), NIBP (systolic, diastolic, mean), SpO_2, pulse rate, temperature, $EtCO_2$ and $FiCO_2$
Synchronization mark:	Heart rate sync mark, pulse rate sync mark, respiratory sync mark

Sound

Sound type:	Alarm, synchronization, click
Alarm sound:	3 types
Synchronization sound:	Pitch variable for IBP and SpO_2

Alarm

Alarm items:	Upper/lower limits alarm, apnea alarm, arrhythmia alarm, connector disconnection alarm, noise alarm, electrode off alarm, pulse waveform detecting alarm, probe off alarm, cuff/hose check alarm, sensor check alarm, battery weak alarm, operating environment alarm
Alarm levels:	Crisis (red blinking), Warning (yellow blinking), Advisory (yellow lighting)
Alarm indication:	Alarm indicator, highlighted message, alarm sound
Alarm suspend:	Provided

ECG

Electrode offset potential tolerance:	±500 mV
Input dynamic range:	± 5 mV
Internal noise:	≤30 µVp-p (Refer to input)
Common mode rejection ratio:	≥95 dB
Input impedance	≥5 MΩ (at 10 Hz)
Input bias current:	≤100 nA
Heart rate count	
Calculation method:	Moving average/Instantaneous beat to beat (selectable)
Counting range:	0, 12 to 300 beats/min (±2 beats/min)
Arrhythmia analysis	
Analysis method:	Template matching method

Number of channels: 1 channel
VPC counting rate: 0 to 99 VPCs/min
Arrhythmia message: ASYSTOLE, VT, VF, VPC RUN, COUPLET, EARLY VPC, BIGEMINY, FREQ VPC, TACHYCARDIA, BRADYCARDIA

Arrhythmia recall:
Number of recall files: 16
Storage time per file: 8 s

ST level measurement:
Number of measurement channels: 1 ch
Measuring range: ±2.5 mV
Alarm limits: ±2.0 mV in 0.01 mV steps, OFF

Pacemaker pulse rejection capability: 0.1 to 2 ms, ±2 to 700 mV
ANSI/AAMI EC 13-1992 compatible
Pacing pulse detection ON/OFF

Defibrillation-proof: ECG input protected against 400 J
IEC 60601-2-27 17.101 compatible

ESU interference filter: Provided

Filters
ON: Time constant 0.5 s, AC hum filter 0.3 to 23 Hz (> –3 dB), ≤ –16 dB (50 Hz or 60 Hz)
OFF: Time constant 3.2 s, 0.05 to 150 Hz (> –3 dB)

Lead:
3-electrode cable: I, II, III
6-electrode cable: I, II, III, aVR, aVL, aVF, V4, V5

Waveform display:
Display sensitivity: 10 mm/mV ±5% (at ×1 sensitivity)
Sensitivity control: ×1/4, ×1/2, ×1, ×2, ×4, or AUTO
Pacing spike display: Available

Heart rate display update cycle: Every 3 s or when alarm is generated

Alarm items:
Upper limit range: 20 to 300 beats/min in 5 beats/min steps, OFF
Lower limit range: OFF, 15 to 295 beats/min in 5 beats/min steps
Alarm items: TACHYCARDIA, BRADYCARDIA, ASYSTOLE

Respiration (Transthoracic impedance pneumography)

Measuring lead: R-F or R-L
Measuring impedance available range: 0 to 2 kΩ
Internal noise: ≤0.2 Ω (Refer to input)
Excitor current: 30 ±10 µArms at 40 kHz
Frequency response: 3.0 Hz ±1 Hz (–3 dB) (Hardware specification)
Time constant: 1.5 s ±0.5 s (Hardware specification)
Respiration counter counting range: 0 to 150 breaths/min
Respiration rate counting accuracy: ±2 breaths/min
Defibrillation proof: Respiration input protected against 400 J discharge

Waveform display:
Display sensitivity: 10 mm/Ω ±20% (at ×1 sensitivity, Zo=480 Ω)
Sensitivity control: ×1/4, ×1/2, ×1, ×2, ×4

Measurement On/Off: Available
Respiration rate display update cycle: Every 3 s or when alarm is generated

- Alarm:
    - Upper limit range: 2 to 150 breaths/min in 2 breaths/min steps, OFF
    - Lower limit range: OFF, 0 to 148 breaths/min in 2 steps
    - Apnea time: OFF, 5 to 40 s in 5 s steps

SpO_2 on BSM-2301/2351

- Measuring range: 1 to 100%
- Pulse rate counting range: 0, 30 to 300 beats/min
- SpO_2 accuracy (bedside monitor only, sensor part not included): ±2 digits ($80\% \le SpO_2 \le 100\%$)
±3 digits ($70\% \le SpO_2 < 80\%$)
- SpO_2 display:
    - Pulse rate display update cycle: Every 3 s or when alarm is generated
    - Sync tone modulation: Change in 20 steps at 81 to 100% SpO_2
- Waveform sensitivity: ×1/8, ×1/4, ×1/2, ×1, ×2, ×4, ×8 or AUTO
- Alarm:
    - Upper limit range: 51 to 100% SpO_2 in 1% SpO_2 steps, OFF
    - Lower limit range: OFF, 50 to 99% SpO_2 in 1% SpO_2 steps

SpO_2 on BSM-2304

- Measuring range: 1 to 100%
- Pulse rate counting range: 0, 20 to 250 beats/min
- SpO_2 accuracy:
    - Adult: ±2 digits ($70\% \le SpO_2 \le 100\%$)
    - Neonate: ±3 digits ($70\% \le SpO_2 \le 100\%$)
- SpO_2 display:
    - Pulse rate display update cycle: Every 3 s or when alarm is generated
    - Sync tone modulation: Change in 20 steps at 81 to 100% SpO_2
- Waveform sensitivity: ×1/8, ×1/4, ×1/2, ×1, ×2, ×4, ×8 or AUTO
- Alarm:
    - Upper limit range: 51 to 100% SpO_2 in 1% SpO_2 steps, OFF
    - Lower limit range: OFF, 50 to 99% SpO_2 in 1% SpO_2 steps

Non Invasive Blood pressure, NIBP

- Measuring method: Oscillometric
- Measuring range: 0 to 300 mmHg
- Accuracy: ±3 mmHg ($0\text{ mmHg} \le \text{NIBP} \le 200\text{ mmHg}$)
±4 mmHg ($200\text{ mmHg} \le \text{NIBP} \le 300\text{ mmHg}$)
- Cuff inflation time:
    - Adult: 7 s
    - Neonate: 5 s
- Initial cuff inflation pressure:
    - Adult: 180 mmHg
    - Neonate: 100 mmHg
- Safety:
    - Cuff inflation maximum pressure: Adult 300 mmHg
Neonate 150 mmHg
    - Safety cuff inflation limiter: Adult 330 mmHg
Neonate 165 mmHg
    - Cuff inflation time limiter: Adult ≤180 s
Neonates ≤90 s

Measurement mode:	Manual
	STAT (Continuous)
	Periodic: 2, 2.5, 5, 10, 15, 30 min, 1, 2, 4, 8 hr interval, PWTT (PWTT is not available on the BSM-2304 monitor)
NIBP data display update cycle:	Updated every measurement
Measurement completion sound:	Generated at every measurement completion when set on the SYSTEM SETUP screen
Alarm:	
Upper limit range:	15 to 260 mmHg in 5 mmHg steps, OFF
Lower limit range:	OFF, 10 to 255 mmHg in 5 mmHg steps

Temperature

Measuring range:	0 to 45°C
Measuring accuracy:	±0.1°C (25°C ≤ Temp ≤ 45°C)
	±0.2°C (0°C ≤ Temp < 25°C)
Temperature drift:	within ±0.005°C /°C
Temperature range:	
Display range:	0°C to 45°C (32 to 113°F)
Display update cycle:	Every 3 s
Alarm:	
Upper limit range:	0.1 to 45°C (32 to 113°F) in 0.1°C (1°F) steps, OFF
Lower limit range:	OFF, 0 to 44.9°C (31 to 112°F) in 0.1°C (1°F) steps

Multi-parameter Amplifier

Measuring parameters:	IBP, respiration (thermistor method), and CO_2 (mainstream)
Input impedance:	1 MΩ ±10%
Excitor output impedance:	< 2 Ω
Excitor current limiter:	< 100 mA
Maximum current from +5 V DC connector:	< 100 mA

Invasive Blood Pressure, IBP

Measuring range:	–50 to 300 mmHg
Measuring accuracy:	±1 mmHg ±1 digit (–50 mmHg ≤ IBP < 100 mmHg)
	±1% ±1 digit (100 mmHg ≤ IBP ≤ 300 mmHg)
Auto zero balancing range:	±200 mmHg
Auto zero balancing accuracy:	±1 mmHg
Transducer sensitivity:	50 µV/V/10 mmHg
Pulse rate counting range:	0, 12 to 300 beats/min
Pulse rate counting accuracy:	±2 beats/min
Noise:	Within ±1 mmHg
Temperature zero drift:	±0.1 mmHg/°C
Frequency response:	DC to 20 Hz ±3Hz
	DC to 12 Hz ±3Hz
Display update cycle:	Every 3 s or when alarm is generated
BP sync sound:	Provided, systolic value 20 to 120 mmHg, changes in 20 steps every 5 mmHg
Alarm:	
Upper limit range:	2 to 300 mmHg in 2 mmHg steps, OFF
Lower limit range:	OFF, 0 to 298 mmHg steps in 2 mmHg steps

Respiration (Thermistor method)

Respiration rate counting range:	0 to 150 breaths/min Apnea, 5 to 40 s
Accuracy:	±2 breaths/min
Noise:	Within 20 Ω (Refer to input)
Frequency response:	3.0 Hz (–3 dB)
Time constant:	≥1.5 s
Waveform display	
Display sensitivity:	10 mm/100 Ω ±20% (at ×1 sensitivity)
Sensitivity control:	×1/4, ×1/2, ×1, ×2, ×4
Respiration rate display update cycle:	Every 3 s or when alarm is generated
Alarm:	
Upper limit range:	2 to 150 breaths/min in 2 breaths/min steps, OFF
Lower limit range:	OFF, 0 to 148 breaths/min in 2 breaths/min
Apnea time:	OFF, 5 to 40 s in 5 s steps

Expired Carbon Dioxide Tension, CO_2

For the TG-900P/TG-920P/TG-950P CO_2 sensor kit specifications, refer to the kit manual.

Measuring method:	Mainstream (TG-900P/TG-920P: semi-quantitative, TG-950P: quantitative)
Measuring range:	
TG-900P/TG-920P:	0 to 76 mmHg
TG-950P:	0 to 99 mmHg
Warm-up time:	5 s (minimum)
Response time	
TG-900P/TG-920P:	200 ms (typical) for steps from 10 to 90%
TG-950P:	60 ms (typical) for steps from 10 to 90%, delay time 100 ms ±10 ms
Detectable respiration rate	
TG-900P/TG-920P:	3 to 60 breaths/min
TG-950P:	0 to 150 breaths/min
Respiration rate counting accuracy:	±2 breaths/min
Measuring accuracy:	
TG-900P/TG-920P:	±4 mmHg ($0 \le CO_2 \le 40$ mmHg) ±10% reading ($40 < CO_2 \le 76$ mmHg) (When 1 atmospheric pressure, air inspiration, no condensation)
TG-950P:	±2 mmHg ($0 \le CO_2 \le 40$ mmHg) ±5% reading ($40 < CO_2 \le 70$ mmHg) ±7% reading ($70 < CO_2 \le 100$ mmHg) (When no condensation, BTPS (body temperature 37°C, ambient pressure, saturated with vapor))
CO_2 value display update cycle:	Every 3 s or when alarm is generated
Alarm:	
Upper limit range:	2 to 99 mmHg in 1 mmHg in 1 steps, OFF
Lower limit range:	OFF, 1 to 98 mmHg in 1 steps
Apnea time:	OFF, 5 to 40 s

Trendgraph

Trend parameters:	Heart rate (or pulse rate), respiration rate, VPC rate, ST level, EVENT (arrhythmia), apnea (time), apnea (frequency), SpO_2, NIBP (systolic, diastolic and mean), IBP (systolic, diastolic and mean), temperature, $EtCO_2$ and PWTT (PWTT is not available on the BSM-2304 bedside monitor.)

Trend times:	1, 2, 4, 8, and 24 h
Data sampling time:	1 min for 1, 2, 4, 8 hours, 3 min for 24 hours

Vital Signs List

Parameters:	Heart rate (or pulse rate), VPC rate, ST level, NIBP (systolic, diastolic and mean), SpO_2, IBP (systolic, diastolic and mean), respiration rate, temperature and $EtCO_2$	
Number of files in list:	Periodic vital signs list:	120
	Entries in vital signs list at NIBP measurement:	120
List interval:	Periodic vital signs list:	1, 5, 15, 30 or 60 minutes
	Vital signs list at NIBP measurement:	at NIBP measurement

Recorder Module (optional, WS-231P)

Recording method:	Thermal array recording	
Number of channels:	3 traces (maximum)	
Recording width:	≥46 mm	
Paper speed:	25, 50 mm/s	
Recording paper:	FQW50-3-100	
Resolution:	Amplitude direction of waveforms:	8 dots/mm
	Time direction of waveforms:	40 lines/mm 8 lines/mm (graphic recording)
Dimensions:	212 mm W × 90 mm H × 140 mm D	
Weight:	1.5 kg	

External Output

External monitor:	Provided

Power Requirement

Line voltage:	117 V ± 10% AC		
Line frequency:	50 or 60 Hz ±2%		
Battery pack (option):	10.8 to 15.0 V ±5%		
Power consumption:	AC operation:	BSM-2301/2304:	70 VA maximum
		BSM-2351:	80 VA maximum
	Battery operation:	40 W maximum	

Clock Accuracy

At operating temperature 25°C:	about ±2 min 40 s/month (maximum)
At storage temperature –20 to 60°C:	about ±5 min/month (maximum)

Environment

Operating environment	
Temperature:	10 to 40°C
Humidity:	30 to 90% RH (0 to 40°C, non-condensing)
Atmospheric pressure:	70 to 106 kPa
Storage environment	
Temperature:	–20 to +60°C –15 to +55°C (Recording paper)
Humidity:	10 to 90% RH (0 to 40°C, non-condensing)
Atmospheric pressure:	70 to 106 kPa

Dimensions and Weight

Dimensions:	BSM-2301/2304:	253 W × 242 H ×145 D (mm)
	BSM-2351:	293 W × 272 H ×149 D (mm)
Weight:	BSM-2301/2304:	approx. 4.7 kg
	BSM-2351:	approx. 5 kg

Electromagnetic Compatibility

IEC 60601-1-2:1993 – Collateral Standard: Electromagnetic compatibility – Requirement and tests

Emissions: CISPR11 Group 1, Class B

Safety Standard

Safety standard: IEC 60601-1:1988 Amendment 1:1991, Amendment 2:1995
IEC 60601-1-1 Amendment 1:1995
IEC 60601-2-27:1994 - Particular requirements for the safety of electrocardiographic monitoring
IEC 60601-2-34:1994 - Particular requirements for the safety of direct blood pressure monitoring equipment
IEC 60601-2-30:1995 - Particular requirements for the safety of automatic cycling in in-direct blood pressure monitoring equipment

According to the type of protection against electrical shock:
CLASS I EQUIPMENT (AC Powered)
Internally Powered EQUIPMENT (BATTERY Powered)

According to the degree of protection against electrical shock
ECG, Respiration (impedance), Respiration (thermistor), IBP, CO_2, Temperature:
Defibrillator-proof type CF applied part
SpO_2, NIBP: Defibrillator-proof type BF applied part

For BSM-2301, depending on the serial number, the degree of protection against electrical shock for the specified parameters may be as follows.

Temperature: CF applied part SpO_2, Respiration (thermistor), CO_2: BF applied part

According to the degree of protection against harmful ingress of water:
IPX0 (ordinary EQUIPMENT)

According to the degree of safety of application in the presence of FLAMMABLE ANAESTHETIC MIXTURE WITH AIR OR WITH OXYGEN OR NITROUS OXIDE:
Equipment not suitable for use in the presence of FLAMMABLE ANAESTHETIC MIXTURE WITH AIR OR WITH OXYGEN OR NITROUS OXIDE

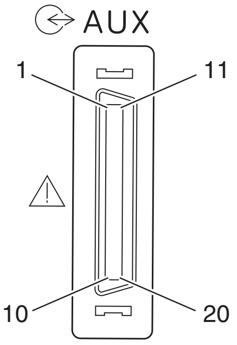
According to the mode of operation: CONTINUOUS OPERATION

Input/Output Socket Pin Assignment

WARNING

Connect only the specified instruments to the connector or sockets marked with ⚠ by following the specified procedure. Otherwise, electrical leakage current may harm the patient and operator.

AUX Socket



Pin No.	Signal	Pin No.	Signal
1	RED	11	RGND
2	GREEN	12	GGND
3	BLUE	13	BGND
4	VSYNC	14	VGND
5	HSYNC	15	HGND
6	NC	16	+5 V PSW
7	NC	17	E2
8	RSTXD	18	RSRXD
9	XRSRTS	19	XRSCTS
10	XRSCD	20	RSDTR

General Requirements for Connecting Medical Electrical System

When more than one electrical instrument is used, there may be electrical potential difference between the instruments. Potential difference between instruments may cause current to flow to the patient connected to the instruments, resulting in electrical shock (micro shock). Therefore, electrical instruments must be appropriately installed as specified in IEC 60601-1-1.

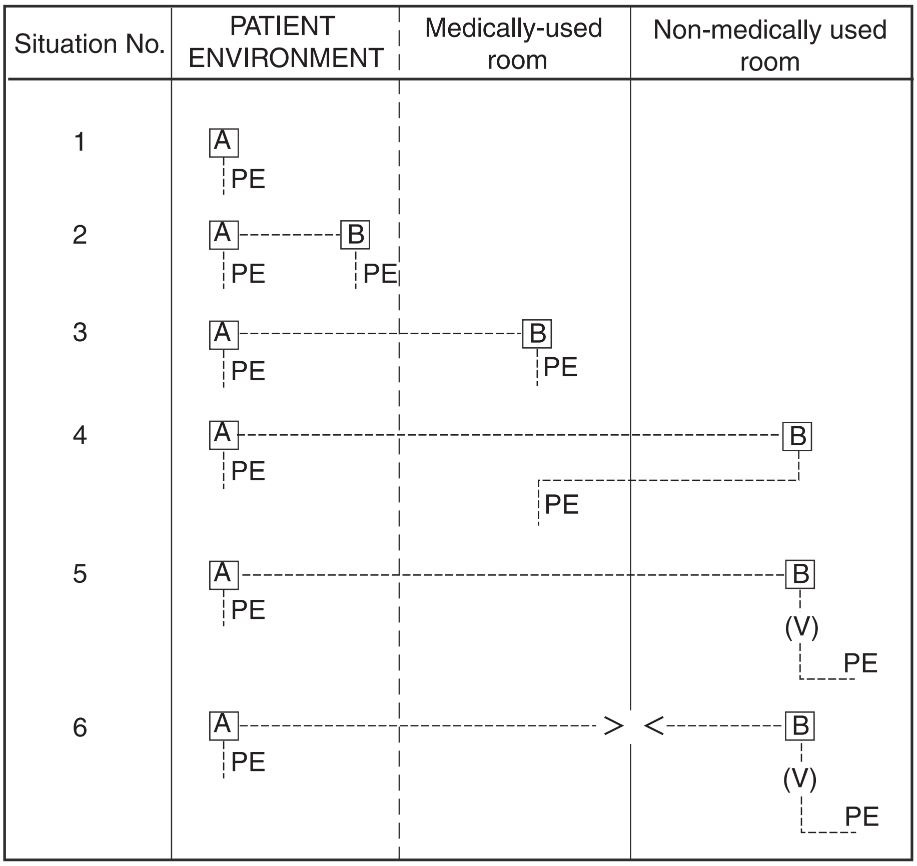
The following is an extract from IEC 60601-1-1 “Medical electrical equipment Part 1: General requirements for safety”. For details, refer to IEC 60601-1-1 and consult with a biomedical engineer.

Examples of combinations of MEDICAL ELECTRICAL EQUIPMENT and non-medical electrical equipment

Situation No.	Equipment A	Equipment B	Solution
1	IEC 60601/X		OK
1a	IEC XXXXX		OK, if ENCLOSURE LEAKAGE CURRENT is less than 0.5 mA. If the ENCLOSURE LEAKAGE CURRENT is more than 0.5 mA: Solution *Q* (separating transformers).
2a	IEC 60601/X	IEC 60601/B	OK
2b	IEC 60601/F	IEC XXXXX	for B any one of *P*, *Q*, *R*
2c	IEC 60601/B	IEC XXXXX	for A solution *P* for B any one of *P*, *Q*, *R*
3a	IEC 60601/X	IEC 60601/B	OK
3b	IEC 60601/F	IEC XXXXX	OK
3c	IEC 60601/B	IEC XXXXX	for A solution *P*
4	See 3a, 3b, 3c		
5a	IEC 60601/X	IEC 60601/B	for A solution *P* or *S* (groundloop possible)
5b	IEC 60601/X	IEC XXXXX	for A solution *P* or *S* (groundloop possible)
6a	IEC 60601/X	IEC 60601/X	OK (with *S*)
6b	IEC 60601/X	IEC XXXXX	OK (with *S*)

IEC 60601/B = IEC 60601-1 EQUIPMENT of TYPE B **with** PATIENT connection
IEC 60601/F = IEC 60601-1 EQUIPMENT of TYPE BF or TYPE CF (or TYPE B **without** PATIENT connection)
IEC 60601/X = IEC 60601-1 EQUIPMENT of TYPE B or TYPE BF or TYPE CF
IEC XXXXX = Equipment complying with e.g. IEC 348, IEC 950 etc.

P: additional protective earth
Q: additional separating transformer
R: floating power supply
S: separation


Situation No.
PATIENT ENVIRONMENT
Medically-used room
Non-medically used room
1
A
PE
2
A
B
PE
PE
3
A
B
PE
PE
4
A
B
PE
PE
5
A
B
PE
(V)
PE
6
A
> <
B
PE
(V)
PE

Legend:

(V) = Potential difference between different localities.

> < = SEPARATION DEVICE.

PE = Protective earth.

Standard Accessories

NOTE

- **Use only Nihon Kohden specified parts and accessories to assure maximum performance from your instrument.**
- **When ordering the following accessories and options, specify the supply code no. When the supply code no. is not provided with the accessory, specify the code no.**

BSM-2301A/2351A

Name	Qty	Code No.	Supply Code No.
Power cord UL	1	505312	_
ECG electrode lead (3 leads)	1	BR-913PA	K910B
ECG connection cord (3/6 electrodes)	1	JC-906PA	K912A
SpO_2 connection cord	1	JL-900P	K931
Air hose for adult/child (3.5 m)	1	YN-901P	S901
Cuff for adult	1	YP-963T	S944B
Cuff for child	1	YP-962T	S943C

BSM-2304A

Name	Qty	Code No.	Supply Code No.
Power cord UL	1	505312	_
ECG electrode lead (3 leads)	1	BR-913PA	K910B
ECG connection cord (3/6 electrodes)	1	JC-906PA	K912A
Nellcor SpO_2 connection cord (OEM-10)	1	635894	_
Nellcor SpO_2 sensor pack (MAXPACI)	1	635902	_
Air hose for adult/child (3.5 m)	1	YN-901P	S901
Cuff for adult	1	YP-963T	S944B
Cuff for child	1	YP-962T	S943C

Options and Consumables

Options for the Monitor

Name	Qty	Code No.	Supply Code No.
Grounding lead	1	544582A	—
Fuse T2.0 A/250 V	1	104522	—
Battery pack, 10HR-4/3FAUC-NK	1	YS-076P5	X062
Hooks	2	DZ-230P	—
Cart	1	KC-013P	—
Network card	1	QI-101P	—
Network printer card	1	QI-111P	—
Recorder module	1	WS-231P	—
Touch pen	1	577297B	Y075
BSM-2300 RGB cable (10 m)	1	YS-076P2	—
BSM-2300 RGB cable (2 m)	1	YS-080P2	—
Interface	1	QI-231P	—
Adapter for attaching interface	1	DI-231P	—
Wireless LAN station	1	QI-210P	—
Interface for Oridion Microcap	1	QI-235P	—
Interface for a display and an external instrument	1	QI-236P	—
Multigas unit	1	AG-920RA	—
Connection cable for optional units	1	YJ-231P	—
Isolation transformer	1	SM-800RA	—

For ECG and Respiration (Impedance Method) Monitoring

Name	Purpose	Length (m)	Qty	Code No.	Supply Code No.
Electrode lead	3 electrodes (AHA) clip type	0.8	1	BR-903PA	K911A
	3 electrodes (AHA) snap type			BR-913PA*	K910B
	6 electrodes (AHA) clip type			BR-906PA	K912A
	6 electrodes (AHA) snap type			BR-916PA*	K915A
ECG connection cord	3/6 electrodes (AHA)	3		JC-906PA	K922A

* This part has not been checked for compliance with the MDD (Medical Device Directive). For EC member countries, Nihon Kohden recommends the use of parts that comply with MDD.

For Respiration Monitoring (Thermistor method)

Name	Length (m)	Qty	Code No.	Supply Code No.
Respiration pickup for nose	3	1	TR-900P*	P901
Respiration pickup for airway	3	1	TR-910P	P902
Airway adapter	—	1	YG-001P	V911

* This part has not been checked for compliance with the MDD (Medical Device Directive). For EC member countries, Nihon Kohden recommends the use of parts that comply with MDD.

For SpO_2 Monitoring

Name	Length (m)	Qty	Code No.	Supply Code No.
SpO_2 connection cord	2.5	1	JL-900P	K931
Finger probe	1.6		TL-201T	P225F
Multi-site probe			TL-220T	P225G
Disposable probe (For adults)		5	TL-251T	P201A
Disposable probe (For children)			TL-252T	P201B
Disposable probe (For neonates)			TL-253T	P201C
Multi-site Y probe (Disposable, for adults, children, neonates)			TL-260T	P205A
Disposable probe (For adults and neonates)	0.8		TL-051S	P228A
	1.6		TL-052S	P228B
Disposable probe (For adults, children and infants)	0.8		TL-061S	P229A
	1.6		TL-062S	P229B
COTTONY tape	—	20	340703*	P259
Sponge attachment tape S for TL-260T multi-site Y probe		24	—	P260A
Sponge attachment tape L for TL-260T multi-site Y probe				P260B
Clip adapter for TL-260T multi-site Y probe		1		P256
Attachment tape for TL-220T multi-site probe		3 × 30		P263
Foam tape for TL-051S/052S/061S/062S disposable probes	—	4 × 25	—	P260

* This part has not been checked for compliance with the MDD (Medical Device Directive). For EC member countries, Nihon Kohden recommends the use of parts that comply with MDD.

For NIBP Monitoring

Name		Width (cm)	Length (m)	Qty	Code No.	Supply Code No.
Air hose for adults/children		—	1.5	1	YN-900P	S901
			3.5		YN-901P	S902
Extension air hose			1.5		YN-990P	S903
Cuff for infants		5	0.15		YP-960P	S943A
Cuff for children	Small	7			YP-961T	S943B
	Standard	10			YP-962T	S943C
Cuff for adult	Standard	13			YP-963T	S944B
	Large	15			YP-964T	S944C
Cuff for thigh		19			YP-965T	S944D
Disposable cuff for infants		6	0.2	20	YP-910P	—
Disposable cuff for children		9			YP-912P	—
Disposable cuff for adults	Small	12			YP-913P	—
	Standard	14			YP-914P	—
	Large	16			YP-915P	—
	Extra large	20			YP-916P	—
Air hose for neonates		—	1.5	1	YN-920P	S904
			3.5		YN-921P	S905
Disposable cuff for neonates	#20	2.5	0.15	10	YP-920P	—
	#21	3			YP-921P	—
	#22	4			YP-922P	—
	#23	5			YP-923P	—
Sterilized disposable cuffs for neonates		3	0.21	1	No. 11*	S260
		4			No. 12*	S260A
		5			No. 13*	S260B

* These parts have not been checked for compliance with the MDD (Medical Device Directive). For EC member countries, Nihon Kohden recommends the use of parts that comply with MDD.

For IBP Measurement

Nihon Kohden and Becton Dickinson (Ohmeda) Reusable Transducers

Name	Length, Description	Qty	Code No.	Supply Code No.
IBP connection cord	For P23XL-1, P10EZ-1 and Becton Dickinson (Ohmeda) transducers, 3.5 m	1	JP-900P	K951
IBP connection cord	For TP-400T and Becton Dickinson (Ohmeda) transducers, 0.3 m	1	JP-910P	K952
IBP transducer	—	1	TP-400T*	—
IBP transducer	—	1	P23XL-1	—
IBP transducer	—	1	P10EZ-1	—
Dome	With membrane	25	TY-410U*	S511
Monitoring kit	For P23XL-1 and TP-400T	5	SCK-520*	S571
Monitoring kit	For P10EZ-1, arm mount	5	SCK-512*	S570
Monitoring kit	For P10EZ-1, pole mount	5	SCK-560*	S572
Dome	Without membrane	1	TA-1011*	—
Dome	With membrane	12	TA-1011D*	—
Super dome	—	10	TA-1015T	—
Dome	With membrane, rotatory luer lock	12	TA-1010ND	—
Dome	With membrane	12	TA-1019	—
Dome	With membrane	12	TA-1019M	—
Super dome	—	10	TA-1017	—
Super dome	—	10	TA-1017M	—
Super dome	—	10	TA-1018	—
Criti flo	—	10	TA-4004	—
Criti flo	—	10	TA-4005*	—
Transducer holder	For TP-400T	1	ZY-101U*	S238
Adapter 2	For P23XL-1, used with ZY-101U	1	—	S239
Pressure tubing	15 cm	25	PT-06	—
Pressure tubing	30 cm	25	PT-12	—
Pressure tubing	60 cm	25	PT-24	—
Pressure tubing	90 cm	25	PT-36	—
Pressure tubing	120 cm	25	PT-48	—
Pressure tubing	150 cm	25	PT-60	—
Microchip pressure transducer	—	1	SPC-370*	—
Connection cable	For SPC, 1.5 m	1	TEC-5C*	—
Connection cable	For SPC, 3 m	1	TEC-10C*	—
Control unit	For SPC	1	TC-510*	—

* These parts have not been checked for compliance with the MDD (Medical Device Directive). For EC member countries, Nihon Kohden recommends the use of parts that comply with MDD.

Becton Dickinson (Ohmeda) Disposable Transducers

Name	Length, Description	Qty	Code No.	Supply Code No.
IBP connection cord	3.5 m	1	JP-900P	K951
Monitoring kit	For cerebral pressure	10	DX-100*	—
Monitoring kit	For neonates	10	DX-200*	—
Monitoring kit	With flush device	10	DX-300*	—
Monitoring kit	For arm mounting	5	DX-312*	—
Monitoring kit	For pole mounting	5	DX-360*	—
Monitoring kit	For pole mounting	5	DX-360R*	—
Monitoring kit	For triple line	3	DX-360TT*	—
Monitoring kit	For pole mounting	5	DX-360SD*	—
Monitoring kit	For double line	5	SCKD-5005*	S568
Transducer fixing plate	—	1	TBG2	—
Transducer fixing plate	—	1	TMM	—
Transducer fixing plate	—	1	UMM	—
Safe needle	For DX-360SD	50	TA-BPN*	—
Arterial blood sampler	For TA-BPN	100	QS-90*	T200A

* These parts have not been checked for compliance with the MDD (Medical Device Directive). For EC member countries, Nihon Kohden recommends the use of parts that comply with MDD.

Baxter Disposable Transducers

Name	Length, Description	Qty	Code No.	Supply Code No.
IBP connection cord	For Baxter transducers, 3.5 m	1	JP-920P	L901

Baxter blood pressure transducers are available direct from Baxter Healthcare Corporation (www.baxter.com) or their suppliers.

Other

Name	Length, Description	Qty	Code No.	Supply Code No.
Catheter	For cerebral pressure measurement	1	TM-200T*	S380
Pressure bag	—	1	ACS-222*	S160
Disposable 3-way stopcock	—	50	318434*	S180
3-way stopcock	3 core	1	MF-3F*	S314
3-way stopcock	5 core	1	MF-5F*	S315
Holder	For 5 core stopcock	1	—	S226

* These parts have not been checked for compliance with the MDD (Medical Device Directive). For EC member countries, Nihon Kohden recommends the use of parts that comply with MDD.

For Temperature Monitoring

Name	Purpose	Length (m) Thickness (F)	Qty	Code No.	Supply Code No.
Thermistor probe	For adult rectum	3.5 m	1	YSI-401JG*	P240A
	For child rectum			YSI-402JG*	P241A
	Disc type			YSI-409JG*	P242A
Probe cover	For YSI-401JG	—	10	—	P249
Temperature insulation pad	For YSI-409JG		5 dozens		P252

* These thermistor probes are available direct from YSI, Yellow Springs Instrument CO., Inc., Yellow Springs Ohio 45387, USA; Phone +1 513-767-7241.

The temperature disposable probes are available direct from Kendall Healthcare Products Company (www.kendallhq.com) or their suppliers.

For CO_2 Monitoring (Mainstream Method)

Name	Length (m)	Qty	Code No.	Supply Code No.
CO_2 sensor kit (CO_2 adapter + CO_2 sensor) for the semi quantitative method	3	1	TG-900P	P903
CO_2 adapter for TG-900P	2	1	JG-900P	K981
CO_2 sensor for TG-900P	1	1	TG-101T	P922A
Airway adapter for TG-900P	—	50	YG-101T	R801
CO_2 sensor kit (CO_2 adapter + CO_2 sensor) for semiquantitative method	3.5	1	TG-920P	P907
CO_2 adapter for TG-920P	2	1	JG-920P	K984
CO_2 sensor for TG-920P	1	1	TG-121T	P923
Nasal adapter for TG-920P (nasal breathing)	—	30	YG-120T	V921
Nasal adapter for TG-920P (naso-oral breathing)	—	30	YG-121T	V922
Nasal adapter for TG-920P (oxygen cannula adjustment)	—	30	YG-122T	V923
Surgical tape	—	1	#1527	Y242
CO_2 sensor kit (CO_2 adapter + CO_2 sensor) for quantitative method	4	1	TG-950P	P905
CO_2 adapter for TG-950P	2	1	JG-950P	K982
CO_2 sensor for TG-950P	2	1	TG-201T	P921
Airway adapter for adult and children (Weight 10 kg), TG-950P	—	30	YG-201T	R802
Airway adapter for children and neonates (Weight 3 to 10 kg), TG-950P	—	30	YG-202T	R803

For WS-231P Recorder Module

Name	Qty	Code No.	Supply Code No.
Thermal head cleaner pen	5	404617	Y011
Recording paper	10	FQW50-3-100	A723